Instruction

You are about to participate in an economics experiment in which you will earn money based on the decisions you and others make. All earnings you make in the experiment are yours to keep. Please do not talk to each other during the experiment. If you have a question, please raise your hand and the experimenter will come and help you.

Overview

- All values and prices will be stated in francs. Each franc you earn can be converted into US currency at the rate specified by the experimenter. The exchange rate **is 12 francs (₣) per dollar ($)**.

- In this experiment, you will participate in a series of auctions that allocates time use of a major piece of scientific equipment. The computer will be the auctioneer and you will compete against 8 other people in the room.

- If you win a time slot at the end of an auction, your profit will be the difference between your value of that time slot and the price you pay for it. If you do not win any time slot, your profit will be zero. Therefore, for you:

$$\textbf{Profit} = \textbf{value} - \textbf{final price}.$$

  Please note that your profit, which will be used to determine a portion of your payment for the experiment, depends on the **difference** between your value and the final price, **not** your value alone.

- At the end of each auction, you will fill out your Auction Worksheet and a monitor will verify your earnings.

Background

You are one of nine scientists who are bidding for access time to a piece of major scientific equipment. Three researchers are conducting big projects, which require at least 3 months of equipment time to complete, while six researchers are conducting smaller experiments that require at least 2 months to complete. The time slots (also called packages) on which you will be bidding are composed of consecutive months within a 24-month timeframe. You only have one experiment that you want to run. No matter how many packages you bid on, you will never be allocated more than one package.

Value Determination

You will have a unique value for each time slot (package) depending on when you are able to start using the equipment as well as the length of time for which you can use your equipment. The values of the various time slots to different researchers depend on several factors.

1). *Value for each minimum package for a small researcher* (2 months) is randomly drawn from the set of integers between 20 and 100, inclusive, where each integer is equally likely to be drawn. A package of fewer than 2 months is worth zero to a small researcher.

2). *Value for each minimum package for a big researcher* (3 months) is randomly drawn from the set of integers between 20 and 150, inclusive, where each integer is equally likely to be drawn. A package of fewer than 3 months is worth zero to a big researcher.

3). *Value for each additional month* is randomly drawn from the interval between 10 and 20, inclusive. Both sets of researchers get added value from using the equipment for more time than the absolute minimum. Small researchers derive more value from using the equipment for 3 months instead of 2, and the most value from using the equipment for 4 months. Using the equipment for five or more months, however, gives them no more value than just using it for four months. Similarly, large researchers get more value from 4 months of use of the equipment as opposed to 3, and they get the most value from using the equipment for 5 months. More than 5 months of time, however, does not give them any additional value.

4). *Starting month*: If your player ID starts with the digit 3, 7, 8, or 9, you prefer to use the equipment earlier rather than later. If your player ID starts with the digit 2, 5, or 6, you are indifferent between starting earlier and later. Finally, if your player id starts with the digit 1 or 4, you prefer to start later rather than earlier.

For each participant, the various components of his or her value will be randomly drawn in each auction. Whether you are a big or small researcher, and whether you prefer to start earlier or later will already be taken into account in the values for packages that you see on your screen.

Auction Process

The experiment may have several auctions. For each auction, you may bid on packages. At the end of each auction, you will see if the bids that you submitted were winning or losing.

Months and Packages

In the experiment, you can only bid on packages, but packages are constructed from individual months. In this case, there are 24 different months. The packages are all the possible ways in which the months can be put together in consecutive order with lengths of 2, 3, 4 for a small researcher and lengths 3, 4, 5 for a big researcher.
The starting month and the length of the package uniquely identify a package. For example, if a package starts on month 1 and lasts for three months, it consists of month 1, month 2, and month 3.
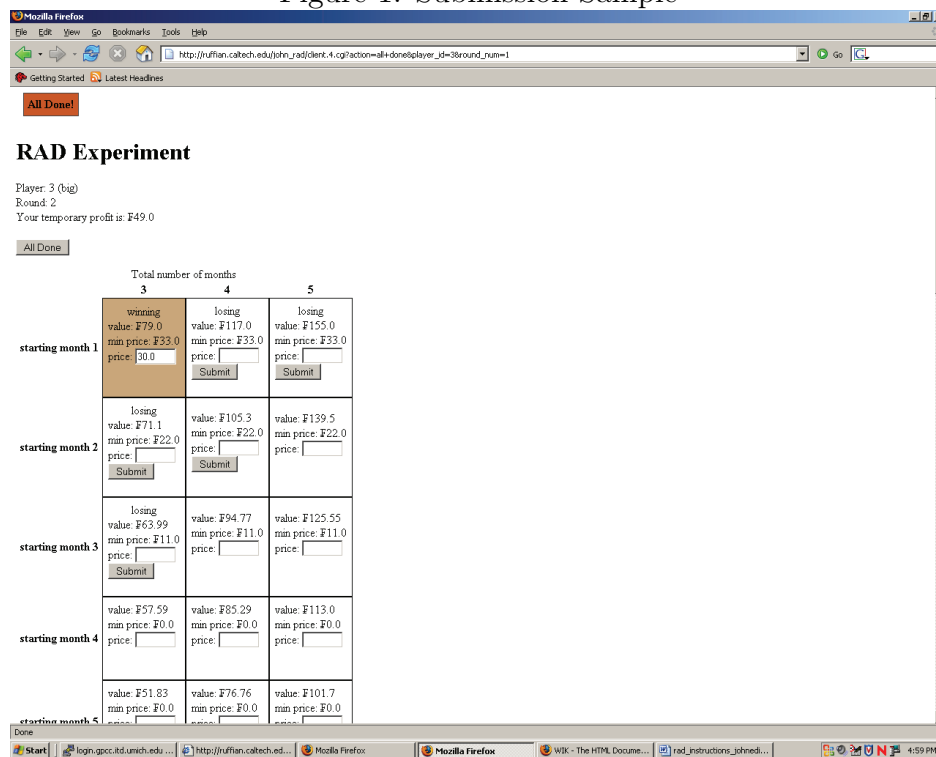
Submitting an Order

The packages will be presented to you in a table format. The different rows will represent different starting months, and the different columns will represent different durations. For example, to find a package that starts on the 4th month, and lasts for 3 months, you will first look for the row that is labeled 4, and find the column that is labeled 3.

In each cell, you will see the value of that package to you. If you wish to bid on that package, you can submit a price in the textbox and then click on the submit button. Note that you will need to click the submit button for each time that you submit a bid. Refer to Figure 1 below to see how your screen will look during the submission process.

If your submitted price is lower than the minimum price, your bid will not be accepted. You are allowed to submit a price for a package that is higher than your value for that package, but if you end up winning the package, you will be making a negative profit. **If you earn a negative profit for an auction, that amount will be deducted from your experiment pay. If your cumulative earning becomes negative, that is if the sum of your show up fee, quiz score, and profit from participating in the experiment is negative, you will be asked to leave the experiment**.

Figure 1: Submission Sample

Canceling an Order

You can always cancel a bid before you click on the All Done button. You can do this by clicking on the Cancel button for the bid that you want to cancel.

All Done Button

Once you have submitted all the bids for a round, please click on the All Done button. You do not have to wait until time runs out before pressing the button. You will be instructed to wait until all the other players have clicked on the All Done button.

Beginning of Next Round

Once all the players have submitted the bids for a round and clicked on All Done, the computer will determine, for each of the submitted bids, if it was winning or losing. The word winning or losing will appear in the corresponding cells.

Eligibility

To encourage active bidding there is a "use it or lose it" rule. In the first round, you can bid for any and all packages. In each subsequent round, you will be allowed to bid only on as many months you have placed bids on in the previous round. The maximum number of months you are allowed to have in all of your bids in a round is called your eligibility. Thus, your eligibility at the beginning of the auction is all the months that you can bid on, which is 24.

> Example: Suppose that in the first round a bidder makes three bids. These are for:
>
> > Bid 1: A package beginning in month 3 and lasting for three months
> > Bid 2: A package beginning in month 4 and lasting for four months
> > Bid 3: A package beginning in month 13 and lasting for four months
>
> The months that the bidder has placed bids on are:
>
> > Bid 1: month 3, month 4, month 5
> > Bid 2: month 4, month 5, month 6, month 7
> > Bid 3: month 13, month 14, month 15, month16
>
> Therefore, the unique months that the bidder has placed bids on are: month 3, month 4, month 5, month 6, month 7, month 13, month 14, month 15, and month 16. This makes a total of nine distinct months. Therefore, the bidder will have an eligibility of 9 in the next round; she will be able to place bids on 9 distinct months.
>
> Note that the eligibility will be computed on your behalf at the start of each round from the bids that you submitted in the previous round. If you are eligible to place a bid on a package, the Submit button will be available to you. The Submit button for a package will not be available to you if placing that package will result in you exceeding your eligibility.
>
> Note that the submission of one bid may affect your eligibility for other bids in the same round.

The Solver

At the end of each round the solver will determine which bids are the temporary winning bids. The solver selects the combination of bids that maximizes the revenue to be received. For simplicity, in all subsequent examples, we assume that there are only three months, and the minimum package is one month.

Example: :
At the end of round 1, the following bids have been submitted:

Bidder 1: month 1, month 2, month 3 = 200
Bidder 2: month 1 = 100
Bidder 3: month 2, month 3 = 75

The solver can choose to allocate the months in two different ways.

1. Give month 1, month 2, and month 3 to Bidder 1. The total revenue is 200.
2. Give month 1 to Bidder 2 and month 2 and month 3 to Bidder 3. The total revenue is 175.

Since the first allocation gives a higher total revenue, the solver will make Bidder 1 the temporary winning bidder of month 1, month 2, and month 3.

If you have a temporary winning bid at the end of a round, that bid will automatically be resubmitted. You may not withdraw a temporary winning bid.

The Calculation of Prices

While the computer is calculating the temporary winning bids, it will also compute prices for each month. In turn, these prices will determine the minimum prices of the packages in the next round. This process takes place in two steps.

First, the computer will first try to calculate prices, one for each month, so they sum up to the temporary winning bids and are greater than any losing bids whenever possible. When this is not possible, the computer will find prices that come as close as possible to meeting the rules. So it is possible that you will have a bid that exceeds the minimum price and yet is not a winning bid.

In the following two examples, a * in front of a bid indicates that it is a temporary winning bid.

Example: 1:

*Bidder 1: month 1 = 30
*Bidder 2: month 2 = 10
*Bidder 3: month 3 = 21

5

Month 1: price 30
Month 2: price 10
Month 3: price 21

Example: 2:
Bidder 1: month1, month 2 = 30
Bidder 2: month 3 = 8
*Bidder 3: month 1, month 2, month 3 = 39

Month 1: price 15
Month 2: price 15
Month 3: price 9

The temporary winning bid is bidder number 3s bid for month1, month 2, and month 3. Choosing it yields the highest revenue. The computer will calculate prices such that:

1. The prices for month 1, month 2, and month 3 add up to 39
2. The prices for month 1 and month 2 add up to at least 30
3. A price for month 3 that is at least 8

If there are several possible solutions then the computer will try to equalize the prices.
Next, after the solver has computed the prices, it sets the minimum prices for the next round by increasing the computed prices by 10%. So, following the result of Example 1, the minimum prices that would be displayed in the next round would be:

Month 1: minimum price 33
Month 2: minimum price 11
Month 3: minimum price 23.1

In the next round, Bidder 1s temporary winning bid of 30 for month 1 will be resubmitted at that price. However, the minimum price for anyone else who wishes to bid on this package will be 33.

Minimum Bids

At the start of each round, a price for each package will be displayed by the computer. Your bid for any package must be greater than or equal to the minimum price posted.

Timing

For each auction, you will be given up to four minutes to submit your bids in the first round. In rounds 2-9 of that auction, you will be given two minutes to submit your bids. In rounds 10 and higher, you will be given one minute. An experimenter will alert you when your time for each round is up and will ask you to click the All Done button if you have not already.

Auction Results

At the end of each auction (not the end of each round), please record your winning package, if any, the value you have for that package, the price you paid for the package, and your profit (value paid price).

Stopping the Auction

Each auction will consist of a series of rounds. The auction will be closed at the end of round T if there is no change in the temporary ownership between the end of round T-1 and the end of round T.

Special Notes

We do not offer any guarantees that the software will not crash. When the computer crashes there may be some excitement, but there is no need to panic.

Worksheet

Please fill out the worksheet completely as instructed. Your values are private information. Please do not reveal them to anyone.

At the end of the auction the owner of each package will receive his or her profit. Again, this is calculated in the following way:

$$\textbf{Profit} = \textbf{value} - \textbf{final price}.$$

Player ID: _____

Player Type: Big or Small (circle one)

Computer #: _____

Review Questions:

(You will be **paid** the specified amount for each correct answer.)

Q.1 Number of temporary winning bids and winning bids. ($1)

a) ($0.25) What is the minimum number of **temporary winning bids** you may have at the **beginning** of a round?

b) ($0.25) What is the maximum number of **temporary winning bids** you may have at the **beginning** of a round?

c) ($0.25) What is the minimum number of **winning bids** you may have at the **end** of the auction?

d) ($0.25) What is the maximum number of **winning bids** you may have at the **end** of the auction?

For questions 2 and 3, refer to the Figure 1: Submission Sample on page 3 of the instruction.

Q.2 ($1)

a) ($0.25) Which package is the temporary winning package for player 3?

b) ($0.25) What is the value of the temporary winning package for player 3?

c) ($0.25) What is the price player 3 is paying for this package?

d) ($0.25) What is the temporary profit for player 3? (Hint: Profit = Value - Price)

Q.3 ($1) For the package that starts on month 2 and lasts for 3 months:

a) ($0.25) Is it possible to submit a price of ₣10?

b) ($0.25) Is it possible to submit a price of ₣25?

c) ($0.25) Is it possible to submit a price of ₣100?

d) ($0.25) If player 3 submits a price of ₣80, and this package becomes the temporary winning bid in round 3, what would be the temporary profit?

Q.4 and Q.5 are on the next page.

For questions 4 and 5, refer to this table.

	Package	Bid
Bidder 1	1–2	₣50
Bidder 2	1–2	₣20
Bidder 3	1–4	₣60
Bidder 4	3–5	₣50

Q.4 Winning Bids ($1) Suppose the bids submitted by four bidders are as listed in the table above. Which set of bids will be marked temporarily winning in Round 2?

Q.5 Eligibility ($1) What is the eligibility for each bidder at the beginning of Round 2?

($0.25) Bidder 1:
($0.25) Bidder 2:
($0.25) Bidder 3:
($0.25) Bidder 4:

Review Questions:

(You will be **paid** the specified amount for each correct answer.)

Answer Keys:

Q.1 Number of temporary winning bids and winning bids. ($1)

a) ($0.25) What is the minimum number of **temporary winning bids** you may have at the **beginning** of a round? **0**

b) ($0.25) What is the maximum number of **temporary winning bids** you may have at the **beginning** of a round? **1**

c) ($0.25) What is the minimum number of **winning bids** you may have at the **end** of the auction? **0**

d) ($0.25) What is the maximum number of **winning bids** you may have at the **end** of the auction? **1**

For questions 2 and 3, refer to the Figure 1: Submission Sample on page 3 of the instruction.

Q.2 ($1)

a) ($0.25) Which package is the temporary winning package for player 3?
The package that starts on month 1 and lasts for 3 months.

b) ($0.25) What is the value of the temporary winning package for player 3? **₣79**

c) ($0.25) What is the price player 3 is paying for this package? **₣30**

d) ($0.25) What is the temporary profit for player 3? (Hint: Profit = Value - Price) **₣49**

Q.3 ($1) For the package that starts on month 2 and lasts for 3 months:

a) ($0.25) Is it possible to submit a price of ₣10?
No, ₣10 is below the minimum price of ₣22.

b) ($0.25) Is it possible to submit a price of ₣25?
Yes.

c) ($0.25) Is it possible to submit a price of ₣100?
Yes, but this will yield to a negative profit of ₣28.9, which is undesirable.

d) ($0.25) If player 3 submits a price of ₣80, and this package becomes the temporary winning bid in round 3, what would be the temporary profit?
This will yield a negative profit of ₣8.9, which is undesirable.

Q.4 and Q.5 are on the next page.

For questions 4 and 5, refer to this table.

	Package	Bid
Bidder 1	1–2	₣50
Bidder 2	1–2	₣20
Bidder 3	1–4	₣60
Bidder 4	3–5	₣50

Q.4 Winning Bids ($1) Suppose the bids submitted by four bidders are as listed in the table above. Which set of bids will be marked temporarily winning in Round 2?
Bidder 1 and Bidder 4's bids(adds up to ₣100).

Q.5 Eligibility ($1)
What is the eligibility for each bidder at the beginning of Round 2?

($0.25) Bidder 1: **2**
($0.25) Bidder 2: **2**
($0.25) Bidder 3: **4**
($0.25) Bidder 4: **3**

Player ID: _____
Player Type: Big or Small (circle one)
Computer #: _____

Player ID: _____

Player Type: Big or Small (circle one)

Computer #: _____

Earning Work Sheet:

Auction #	Winning Package (starting month, package length)	Value	Profit
Example	(2,3)	100	20
Auction 1			
Auction 2			
Auction 3			
Auction 4			
Auction 5			
Auction 6			
Auction 7			
Auction 8			
Total		Auction Profit=	

(_____ / _____) + _____ + _____ = _____
Auction Profit   Exchange Rate   Quiz Score   Show Up Fee   Total Earning

Player ID: _____
Player Type: Big or Small (circle one)
Computer #: _____

Demographics Information

Age: _____

Gender: _____

Major: _____

Undergrad:
First Year, Second Year, Third Year, Fourth Year, Fifth Year, Six or more
     Or
Grad:
First Year, Second Year, Third Year, Fourth Year, Fifth Year, Six or more

Number of Game Theory Classes Taken:_____

Have you discussed auction strategy in any of your courses? Yes or No.
If so, which courses?

Strategy (record the strategy you used here and on the back):

1. How did you decide which packages to bid on?

2. How did you decide what price you were willing to pay for each package?

3. Did you consider the valuation of others in determining your bids?

4. Did you consider your type (big or small) and whether you preferred early or late months in determining your bids?

5. Additional Comments