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Carnegie Mellon University  
Auctions and Markets 73-440  
Second Semester 2007-2008

## **SECOND PROJECT**

### **MARKET MICROSTRUCTURE**

This is the second of three projects. The second project is organized around designing, running, and reporting on, two experiments. The experiments should be on multiunit auctions, monopoly, duopoly or competitive equilibrium in one or more markets. As before you may do the project by yourself, pairs or in groups of three (in which case all students will be awarded the same grade), but no more than three in a group is permitted.

Parts A and D together essentially consist of a short paper. Part A should motivate the experiments with a model, explain the most important features of the model and, if possible, its solution. Part D should describe how the experiments were conducted, and compare the experimental outcomes with your theoretical predictions.

You will be graded on the nature of the issues (such as whether the questions you pose are interesting to business people, and why your experiments might shed light on them), as well as the analysis itself. Part A of this project is due Thursday, March 20 and worth one third of the points. Parts B and C will be conducted in class at that time (and also continuing on Tuesday March 25) and together are also worth one third. Part D is Tuesday, April 1. Parts A and D are reports of your analysis. The points in Part B are allocated to how well your group runs your own experiment. (Typically students score full marks on this, so I will only subtract marks from part C if things are done really badly.) Part C is based on how well you perform as an individual subject in experiments designed by the others.

#### **Part A**

Design the two experiments based on a multiunit auction, a monopolist or a limit order market. In the description of each clearly specify the distribution of valuations throughout the player population, the information that different types of players have, and the rules which govern trade. You should be able to predict the outcomes of at least one of your experiments, based on what you have learned in this class about auctions, or what you have learned in other microeconomics classes about monopoly and competitive equilibrium.

**YOUR TOTAL GRADE ON THIS PROJECT WILL BE INCREASED BY 30 PERCENT IF YOU ARE COMPLETELY READY TO RUN YOUR EXPERIMENTS ON THURSDAY MARCH 20. TO OBTAIN THIS 30 PERCENT BONUS YOU MUST EMAIL YOUR EXPERIMENTS TO ARI KANG BEFORE CLASS THURSDAY. MOREOVER GROUPS WILL BE**

**PENALIZED AN ADDITIONAL 20 PERCENT IF LESS THAN HALF THE CLASS ARE ELIGIBLE FOR THE BONUS.**

There should be some common features between the experiments, so that you can attempt to show what happens as you change the parameters that describe your environment. For example, how are the results of a competitive equilibrium likely to be affected by the number of suppliers and demanders, the distribution of their valuations, whether they are differentially informed or not about the objects being traded, or which players are able to make limit orders as well as market orders? You are not expected to analyze all the possibilities, but I would like you to focus on some questions that are of interest to you.

If your experiment is an auction, you should know whether it has a solution or not (for example whether revenue equivalence holds or not, and if so how to derive the solution, at least in principle). If you are running a monopoly model where quantity sold is also a variable, you should know how to derive the profit maximizing solution when there is a uniform price and also when there is price discrimination. If you are running a market where there is more than one buyer and more than one seller, you should be able to derive the competitive equilibrium price and allocations.

**Part B**

Run the two experiments and send the teaching assistant the output files from your experiments. Students who do a poor job of running their own experiments will also be penalized up to 50 percent of this portion of the project because it may compromise their results. This session will probably be very busy, so everyone should know exactly how to run their own experiments on both modules, and save their results before the sessions begin. I urge you to conduct some trials with your study partners and thoroughly familiarize yourself with the process of running experiments and saving the results. Please make a brief oral presentation (maximum 2 minutes) to the class that motivates your two experiments using a power point presentation (maximum three slides). You should treat the class as future business colleagues who have not taken this course. Please bring a flash drive to the run the power point presentation off my computer, but you should conduct the experiment off your own computer.

**Part C**

Participate as a player in the other experiments. During the session you may use a proxy name rather than your real one to hide your true identity. If you did not use your real name, please send me email at the end of the session divulging your proxy name. Your grade in this portion of the project will be a strictly monotone increasing function of how well you play the games designed and run by the other students (where you are one of their subjects).

**Part D**

Write a report on your findings. Please send Ari Kang a consolidated copy of your report (including Part A as well), and also an attached file of the output from your experiments. (Also include your power point presentation as an appendix.) The second part of the report should include two sections.

1. Your report should describe how each subject performed in each experiment. For each subject, how many points did they score in your game in each of their player roles, and how many points would they have scored if everyone had played according to the predictions of your theoretical model? Write this down as a proportion, average over both your games, and rank the subjects against each other.
2. The second part of the report should also explain the main features of the sample population of subjects, using statistics and econometrics to help summarize the data from your experiment. Explain the main features in your data that summarize the behavior of the class as whole for your experiment. You should use bar charts, pie diagrams and other relevant graphical devices to illustrate your points. When arguing how well the theory works you should know how to adjust for sampling error with t statistics, confidence intervals and so on. By all means, estimate some parameters of interest to your research questions, provide some confidence intervals, and test some hypotheses of interest to your project. Focus on the extent of deviations in the experimental outcomes from the theory, seeking to explain why. (Did some subjects fail to optimize in all the rounds, or did people learn?) The kinds of features you should focus upon depend on the game. For example:
  - In a sequential auction do prices follow a random walk or do they trend?
  - In experimental sessions does the reservation price depend on the number of bidders?
  - How much of the potential surplus does the monopolist extract? How much surplus do consumers extract?
  - Which consumers extract the most surplus?
  - What proportion of the potential gains from trade is realized?
  - In experimental sessions do monopolists charging a uniform price reap more rent than monopolists practicing price discrimination?
  - How much extra advantage does an intermediary controlling the flow of buy and sell orders by setting prices for buyers and sellers and thus always being on one end of the transaction have, compared to an intermediary who only has an information advantage about order flow?

- How are the gains from trade affected by competition from consumers who maintain a durable good?
- How many rival producers are necessary to generate outcomes where consumers reap the entire potential trading surplus?
- To what extent does the strategy space in a monopolistically competitive market determine the experimental outcomes?
- To what extent are arbitrage restrictions respected in limit order markets? Can you identify market factors that are more likely open up arbitrage opportunities?
- Use sample population of subjects, using statistics and econometrics to help summarize the data from your experiment. Explain the main features in your data that summarize the behavior of the class as whole. For example:
- Graph the prices paid by buyers as a function of their valuations, and contrast the valuations of buyers with those who neither buy nor sell, and those who sell. Plot the regression of purchase price against valuation in the diagram.
- In games where there are durable goods graph the time a player buys the good against his valuation. Do buyers who derive greater amenity from a durable good buy it earlier? Plot the regression of purchase time against valuation in the diagram.
- Do prices rise, fall or follow a random walk in a sequential auction where multiple units are sold? Graph the empirical distribution of price changes that are observed in the experimental data, as a function of the number of items sold. You can test the null hypothesis of a random walk by regressing the first difference of successive prices on the number of items remaining to be sold.
- In a limit order market where there are multiple securities traded, display on a graph of time where gains from arbitrage were left unexploited, and which subset of traders “left money on the table”.