Introduction

Behavioral economics often studies how people can maximize their utility, which can be summarized as trying to get the best "deal" possible. In simple terms, if I am willing to pay something similar to 100 dollars, and I get it for 50, then in some sense I have a utility of 50. This can be applied to the context of bidding, wherein there is often asymmetrical information since one person may not know another's bid. Based on our results, it is possible to find the optimal bid (most utility) once one knows all of the other bids by calculating the expected utility by taking into consideration the lower bids and finding the probability of winning and the utility when winning given a certain bid. It is also possible to find a reasonable hypothesis of what

Preliminaries

We had this exact situation where we had to bid based on valuations given to us, where we were given our true values for hypothetical goods A and B, and then we had to indicate what we would bid in a first price auction, where the highest bidder wins and pays their bid. Once all of us placed our bids, all of the values were available to us which included each person's value and bid for both goods A and B. Thereafter, we believed that people generally bid ⅔ of their value, and we attempted to prove this by looking at scatter plots on Excel which showed this exact relationship and the trend of how people's bids changed according to their value.

Calculate your winning probability and expected utility with your bids submitted in Ex 1.2 based on $v_a$ and $v_b$ respectively
We sorted the columns based on the bids and we found that we beat 27 of 54 of the bids, which means that if chosen randomly from the various columns, we would have a probability of 50% of winning. The expected utility for our bid was $(13.1 - 13.1) * .5 = 0$; this was an early indication that it might not have been good to bid our value.
In the B bid, we had a 59% probability of winning since we beat 32 out of 54 teams, and the expected utility when we won was 1.18 since we bid 2 below our true value. Since the expected utility when we lost was just 0, our total expected utility is 1.18.

Calculate the optimal bid which maximizes your expected utility given the opponent's bid based on $v_a$ and $v_b$ respectively.
We know where we are placed amongst all of our classmates and their bids. For all the bids lower than ours, we can try bidding just above them and calculate our expected utility. After building a script for this, we found that the following bids were the optimal ones.
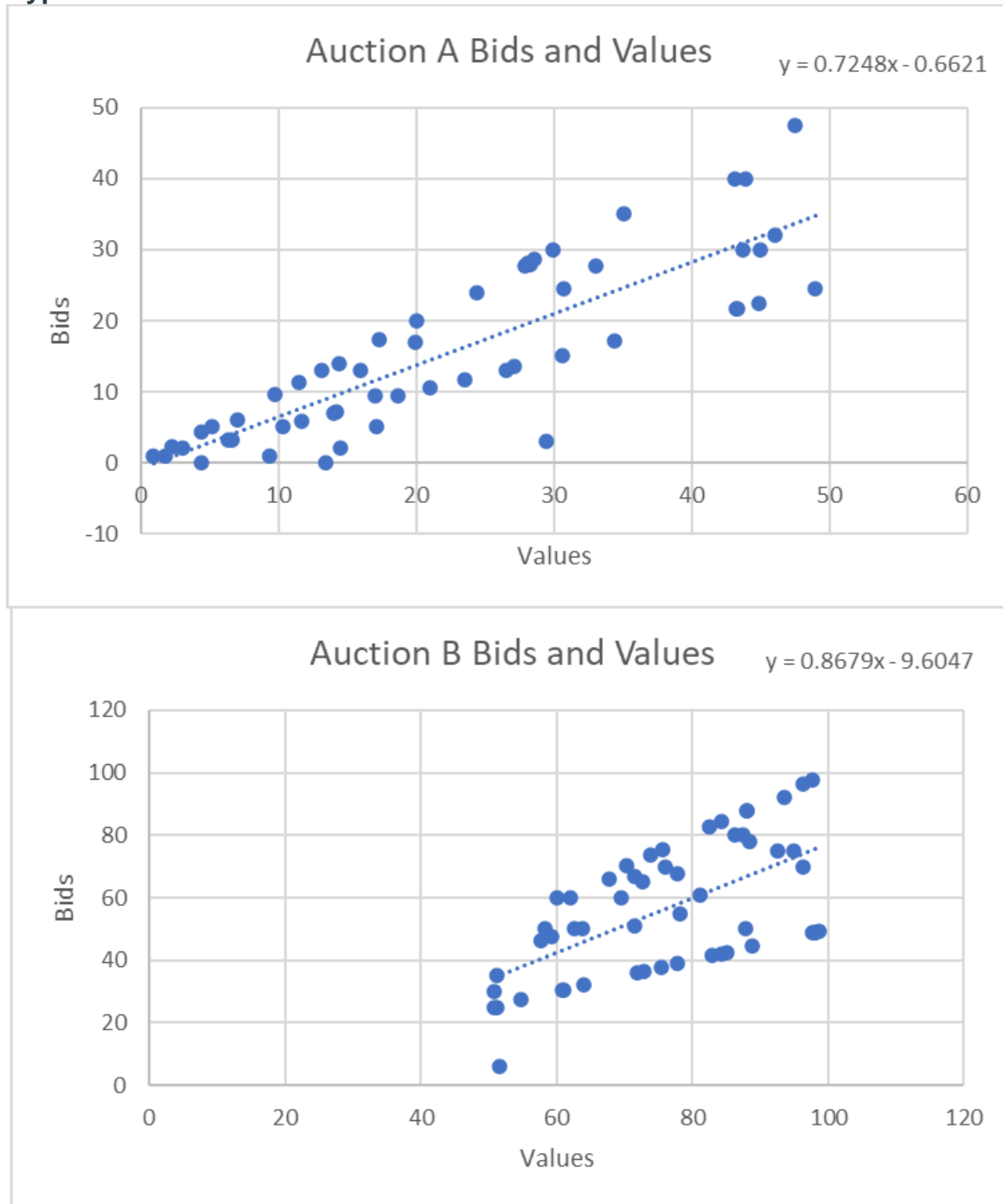Bid Values A: Expected Utility with a bid of 6.01 = 17/56 * (13.1 - 6.01) = 2.23
Bid Values B: Expected Utility with a bid value of 50.11 = (16/56) (62-50.11)=5.73

Compare the utility you obtained to the optimal utility you could have obtained.  Can you conclude anything about a good strategy in this auction?
The utility we obtained was 0 and the one we could have obtained is 2.23 - significantly higher!

Come up with an interesting hypothesis about how bidders will bid in first-price auctions. Evaluate your hypothesis on the data set. Discuss any conclusions you can make from your study.

**Hypothesis: The bidders will bid two-thirds of their value.**

### Auction A Bids and Values

$y = 0.7248x - 0.6621$



### Auction B Bids and Values

$y = 0.8679x - 9.6047$



After removing an outlier (where the bid was higher than the value) from the dataset, we created scatter plots with bids on the y-axis and values on the x-axis for each auction. From the scatter plots, we saw that the data points were lined up in a linear fashion.

Thus, we found the linear slope for each line using excel: 0.7248 for auction A and 0.8679 for auction B. The slope represented bid over value; in other words, what percentage of their value bidders bid for each auction.

Since our hypothesis was that bidders would bid two-thirds of their value, the slope should have been around 0.75 for our hypothesis to be valid. The average slope value for the two auctions is 0.79635, which yields a 6.18% error. Although this is not a terrible error, the results seem to tell us that the bidders tend to bid slightly more than our original hypothesis. We can also dive deeper by analyzing the y-intercepts. For auction A, the y-intercept, -0.6621, was very close to 0, while for auction B, the y-intercept, -9.6047, was considerable. First, we can see that the average values for auction B are higher. The big y-intercept for auction B tells us that if the values are higher, people are more likely to bid more than they would when their values are lower. One possible explanation of this behavior is that once a bidder knows that their value lies on the upper side of the uniform distribution of values from 0 to 100, they are more likely to want to guarantee their win by bidding more than they normally would. Although they would not maximize their utility for each round they win, they could win more rounds, thereby increasing their expected utility.

In conclusion, our hypothesis of bidders bidding two-thirds of their value was not too accurate with a 6.18% error, but we were able to learn that based on the size of a bidder's value, their bid percentage changes. It is difficult to generalize these results in a professional betting environment because our study was done in a casual classroom setting, it does tell us that people are more likely to take risks if they know that their chances of succeeding are higher.