



FINANCE AND ECONOMICS CLUB

# GAME THEORY

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# OVERVIEW

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- AUCTION AND ITS TYPES
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# INTRODUCTION

This is a research-based project centred around game theory, where we shall analyse experimental data which will be obtained using two auction games that are designed by us.



# THEORY OF AUCTIONS

## What Is an Auction?

An auction is a sales event wherein potential buyers place competitive bids on assets or services either in an open or closed format. Auctions are popular because buyers and sellers believe they will get a good deal buying or selling assets.

## Types of Auction

- First price, sealed bid auction
- Second price, sealed bid (Vickrey) auction

## FIRST PRICE, SEALED BID AUCTION

A first-price sealed-bid auction is a common type of auction. In this type of auction, all bidders simultaneously submit sealed bids so that no bidder knows the bid of any other participant.

The highest bidder pays the price that was submitted.

## Second price, Sealed bid (Vickrey) Auction

In this type of auction, all the bidders simultaneously submit sealed bids to the auctioneer. No bidder knows the bid of any other participant.

The highest bidder wins and pays the value of the second-highest bid.

# GAME 1

## BASED ON THE PRINCIPLE OF FIRST PRICE AUCTION



# IMPLEMENTATION

- The bidders can bid any amount between \$40 and \$100.
- Each player will submit 1 sealed bids per round.
- We fix the number of rounds for this game that is 10.

Overall winner is the one who wins maximum rounds. We calculate  $[bid - \log(max\ bid + 1)]$  for each round for the overall winner, and sum the same for 10 rounds.

$$\text{Payoff} = [ \sum \{ bid - \log (max\ bid + 1) \} ] / 10$$

In case of a tie winner is randomly decided

Round	A	B	C	M=bid-log(max bid+1)
1	70	97	92	95.008
2	98	74	81	72.004
3	97	70	91	68.008
4	72	78	73	76.102
5	79	97	71	95.008
6	97	76	87	74.008
7	74	92	85	90.03
8	82	90	78	88.04
9	70	91	75	89.036
10	76	77	71	75.10

- The player with the highest bid for the maximum number of rounds is considered the overall winner. In this case, it is player B.
- Now, going by the devised formula we take the bid of player B in each round(bid), and for each round calculate the highest bid(max bid).
- After obtaining the M value for each round, find the mean of all the M values.
- The obtained mean is the required payoff to be paid by the winner.

Payoff = sum((bid-log(max bid+1)))/10

Payoff = 82

Player B wins the game and has to pay \$82.

# GAME 2

BASED ON THE PRINCIPLE OF SECOND  
PRICE AUCTION



# IMPLEMENTATION

- The bidders can bid any amount between \$40 and \$100.
- Each player will submit 1 sealed bids per round.
- We fix the number of rounds for this game that is 10.

Overall winner is the one who wins maximum rounds. We are taking the root of second highest bid for all the rounds the overall winner has won, and then taking the rms of those values and multiply it with the number of rounds he won.

**PAYOUT= [ rms { root of second highest bid for all the rounds the overall winner has won} ] \* ( 10-1 )**

In case of a tie winner is randomly decided.

Round	A	B	C	sqrt(second highest bid)
1	69	49	52	7.211
2	58	68	99	8.24
3	91	47	55	7.41
4	79	52	65	8.06
5	87	55	77	8.77
6	81	41	88	9
7	59	76	66	8.12
8	54	48	41	6.92
9	42	95	52	7.21
10	80	87	96	9.32

- The winner, in this case, is player A.
- Now, we take those rows in which player A is the winner and take the root of the second-highest value in that row, i.e. in rows 1,3,4,5 and 8.
- Now take the rms value of these values and multiply it with (n-1).

PAYOUT = [ rms { root of second highest bid for all the rounds the overall winner has won } ] \* ( 10-1 )

Payoff = 69

Player A wins the game and has to pay \$69.

code for game 1 and game 2



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Thank  
You