Finance & Economics Club

Game Theory

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Overview

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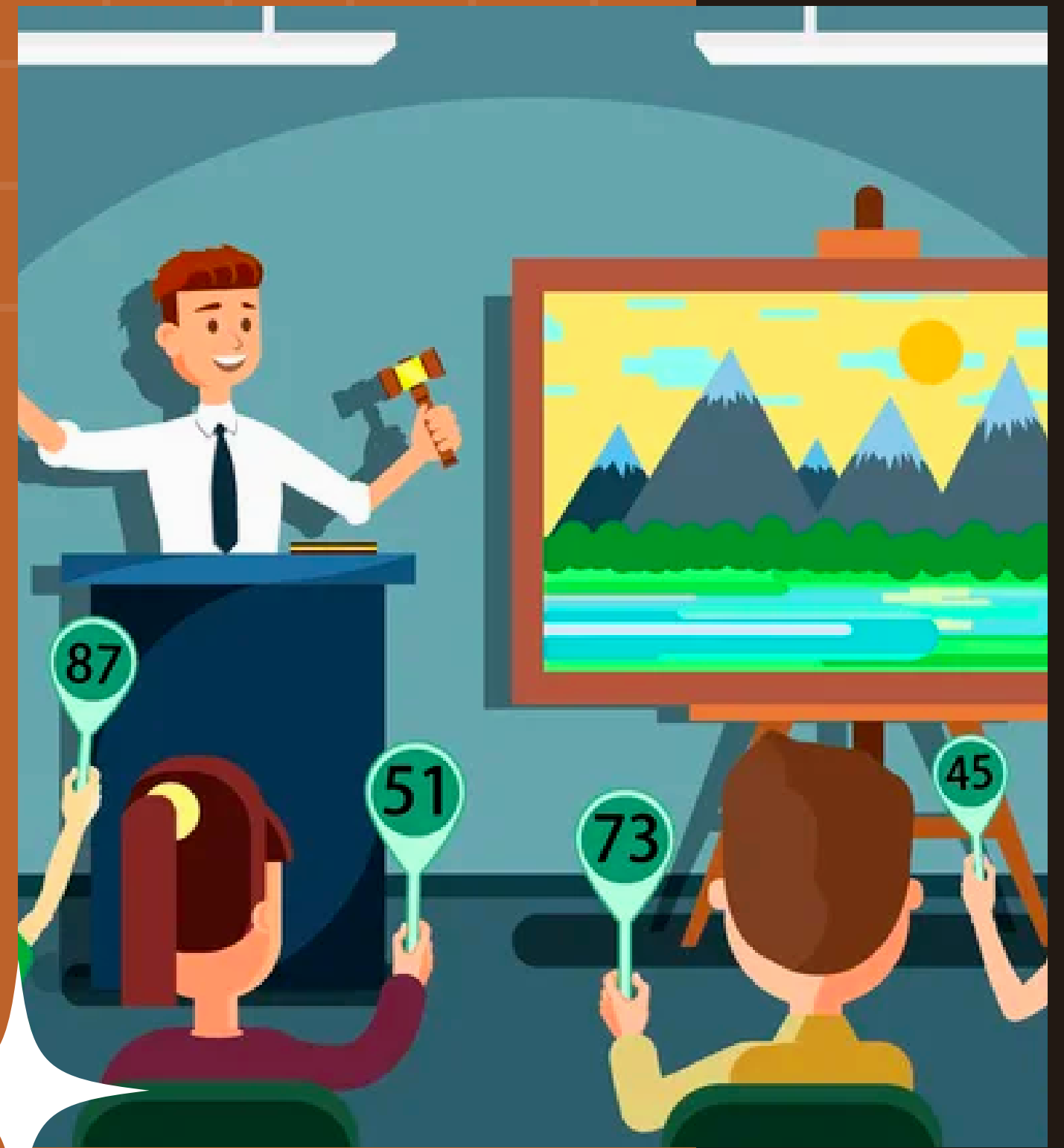
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- Implementation
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Introduction

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.

Auction

What is an auction?

An auction refers to the sale of goods or services by offering them up for bids

Auctions are based on the idea that competitive bidding tends to push prices higher, thus maximising profits

Types of Auctions

We shall be analysing two types of auctions:

1. **First-price, sealed-bid auction**

2. **Second-price, sealed-bid (Vickrey) auction**

Theory of Auctions

✦ **First-Price, Sealed-Bid 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 their bid

✦ 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
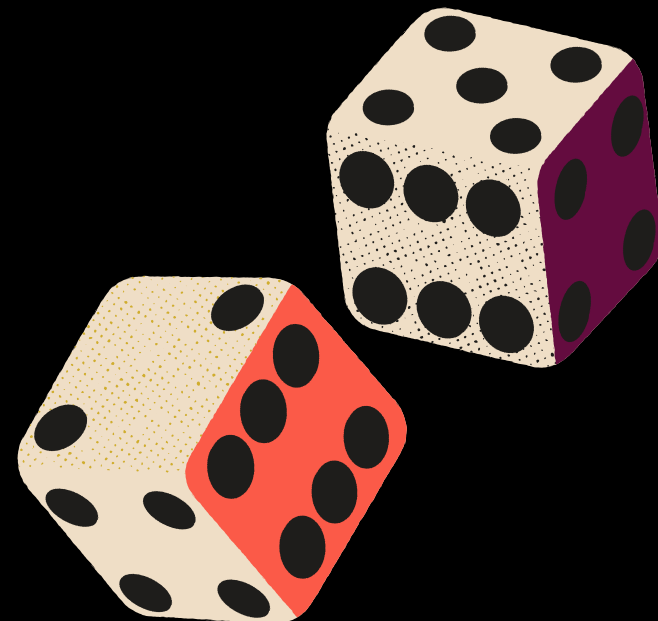
These types of auctions are named after William Vickrey, an economics professor and Nobel Laureate. He was the first to use the tools of game theory to explain the dynamics of auctions.

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Game 1

BASED ON THE PRINCIPLE OF FIRST PRICE AUCTION

IMPLEMENTATION

- The bidders can bid any amount between $10 and $100.
- Each player will submit 2 sealed bids per round.
- We fix the number of rounds for this game that is 10.

Winner of each round is the bidder whose average of both the submitted bids is closest to the root mean square of all the bids placed in that round.

Winner will pay an amount that is equal to the average of maximum of the 2 bids placed by the winner in all the rounds

Payoff= sum(max(bid1,bid2))/10

In case of a tie winner is randomly decided!

ROUND	A		B		C	
	Bid 1	Bid 2	Bid 1	Bid 2	Bid 1	Bid 2
1	99	27	60	89	38	86
2	60	61	59	59	53	56
3	32	62	64	69	63	10
4	70	88	11	63	17	90
5	45	71	24	78	80	39
6	63	98	32	32	36	50
7	78	12	96	59	84	16
8	89	85	99	72	85	35
9	27	53	79	67	42	28
10	13	39	86	28	29	54

- For round 1 ,the rms of all the bids is 71.75 which is closest to the average of the two bids of B. Thus B is the winner.
- Similarly we choose the winner of the other rounds.
- B wins 4 rounds, C wins 4 rounds and A wins 2 rounds.
- Thus the winner is randomly decided i.e. B as there is a tie between B and C.

PAYOFF

The winner will pay the average of maximum of both the bids in all the rounds i.e.

=(89+59+69+63+78+32+96+99+79+86)/10

=75

Player B wins the game and will pay $75

Link to the excel sheet:

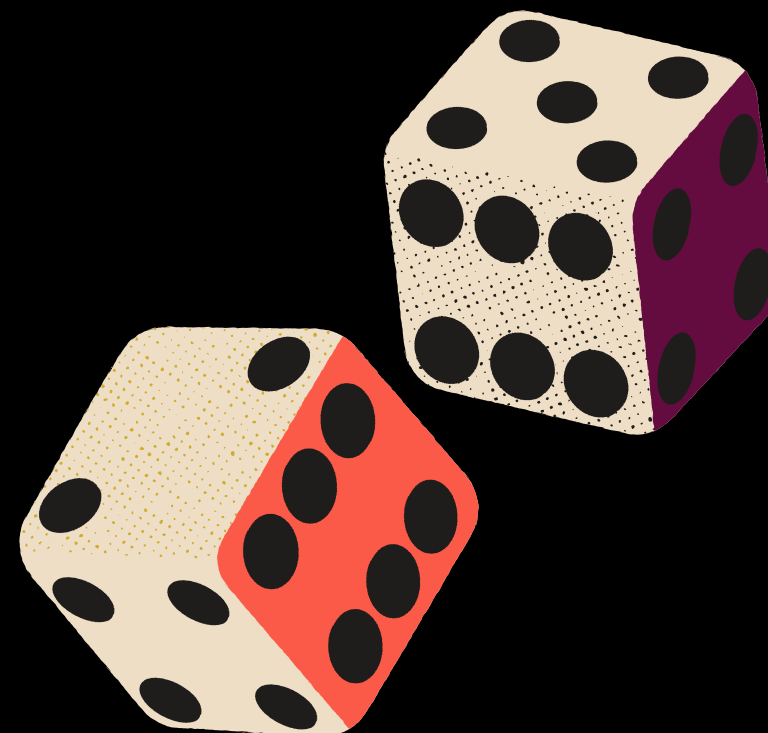https://docs.google.com/spreadsheets/d/1VBoWkL6fySd-5ZDC8TOESz1ui8VSJfvtUwt57sWqiBk/edit?usp=sharing

IMPLEMENTATION

- The bidders can bid any amount between $20-$100
- Each player will submit 1 sealed bid per round.
- The number of rounds will be nearest integer to log2n where n is the highest bid placed in the first round.

Winner of a particular round will be the bidder with the maximum bid

Winner will pay an amount $5 more than lowest bid in the round number closest to log2n/2

In case of a tie we decide the winner by rolling a die!

ROUND	A	B	C
1	60	96	29
2	28	86	26
3	95	45	25
4	93	79	88
5	87	68	56
6	92	49	64
7	99	66	95

- The number of rounds will be approximately 7(closest to log2(96).
- Winner of round 1 will be B(maximum bid).
- B wins 2 rounds, A wins 5 rounds, C wins 0 rounds.
- Thus the overall winner will be A.

PAYOFF

The winner will pay $5 more thanthe lowest bid in round number 3 i.e.

=25+5

=30

Player A wins the game and will pay $30.

Link to the excel sheet:

https://docs.google.com/spreadsheets/d/1ABYeUw9GXc5fOzwkF4O6CQeXhHxtUZHhHBSNG4VY93I/edit#gid=0

Thank You!