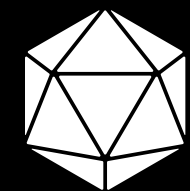


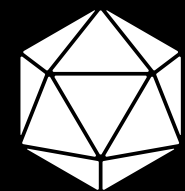
# GAME THEORY

Presented by Abhinav Sharma

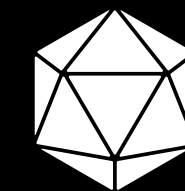
# OVERVIEW



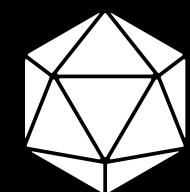
Introduction



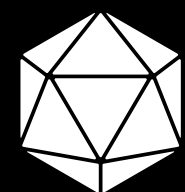
Game 1



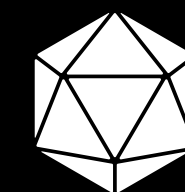
Game 2



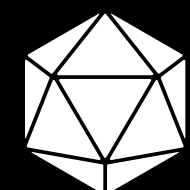
Auction and its types



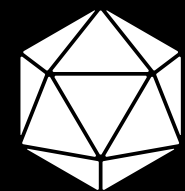
Implementation



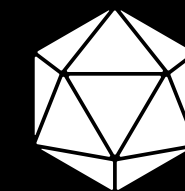
Implementation



Theory of Auctions



Payoff



Payoff



# 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**

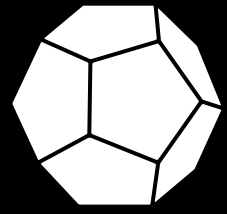
Auctions are based on the idea that competitive bidding tends to push prices higher, thus maximising profits

## ★ Type of auction ?

We shall be analysing two types of auctions:

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

# Theory of Auctions



## First-Price, Sealed-Bid Auction

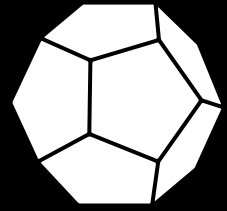
**Sealed Bids:** First-price, sealed-bid auctions involve participants submitting secret bids for an item.

**Winner's Payment:** The highest bidder wins and pays the amount they bid.

**Strategic Bidding:** Bidders aim to balance winning and avoiding overpayment.

**Revenue Generation:** The seller receives the highest bid as revenue.

**Common Use Cases:** This auction type is utilized in government procurement, art auctions, and real estate sales, among others, due to its simplicity and efficiency.



## Second-Price, Sealed-Bid (Vickey) Auction

**Sealed Bids:** First-price, sealed-bid auctions involve participants submitting secret bids for an item.

**Winner's Payment:** The highest bidder wins and pays the amount they bid.

**Strategic Bidding:** Bidders aim to balance winning and avoiding overpayment.

**Revenue Generation:** The seller receives the highest bid as revenue.

**Common Use Cases:** This auction type is utilized in government procurement, art auctions, and real estate sales, among others, due to its simplicity and efficiency.

# GAME 1

BASED ON PRINCIPLE OF FIRST AUCTION PRICE

# 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.

$$\text{Payoff} = \text{sum}(\max(\text{bid1}, \text{bid2}))/10$$

In case of a tie winner is randomly decided!



	A		B		C	
ROUND	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 winner.
- Similarly we choose the Winner of other round.
- B wins 4 rounds , C wins 4 rounds and A wins 2 rounds.
- B wins 4 rounds C wins 4 rounds and A wins 2 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 rounds i.e.

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

$$=75$$



Player B wins the game and will pay \$75

# GAME 2

BASED ON PRINCIPLE OF SECOND AUCTION PRICE



# 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  $\log_2 n$ .
- 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  $\log_2 n / 2$

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

ROUND	BID 1	BID 2	BID 1
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  $\log_2(96)$ ).
- 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 than the lowest bid in round number 3 i.e.

$$=25+5$$

$$=30$$



Player A wins the game and will pay \$30



**THANK**

**YOU**