GAME THEORY

Finance and Economics Club
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Presented by:

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Contents:

Introduction :

- **What is Game Theory ?**

  Game theory is a theoretical framework for conceiving social situations among competing players. In some respects, game theory is the science of strategy, or at least the optimal decision-making of independent and competing actors in a strategic setting.

- **Our Project :**

  In this project, we have devised two games based on the first-price, sealed-bid auction and the second - price, sealed - bid (Vickrey) auction and tried to analyze the experimentally obtained data to show game theory in action.

Auction and its types:

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.

Types of auction :

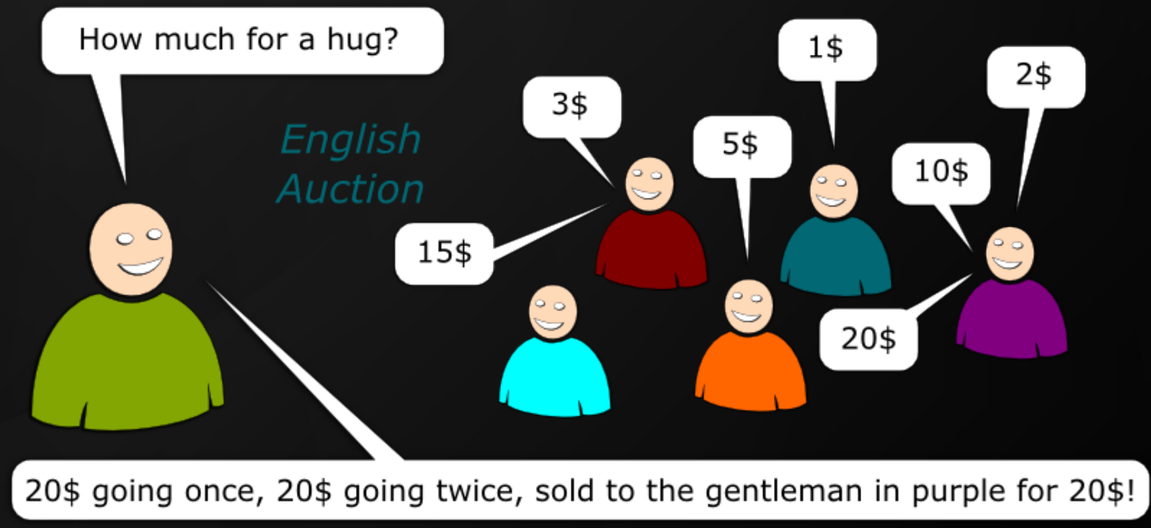
There ae primarily 4 types of auction:

- The ascending - bid (open, oral , or English) auction
- The descending - bid (Dutch) auction
- The first-price, sealed-bid auction
- The second - price, sealed - bid (Vickrey) auction

POOL B:

- **FIRST-PRICE SEALED BID AUCTION:**

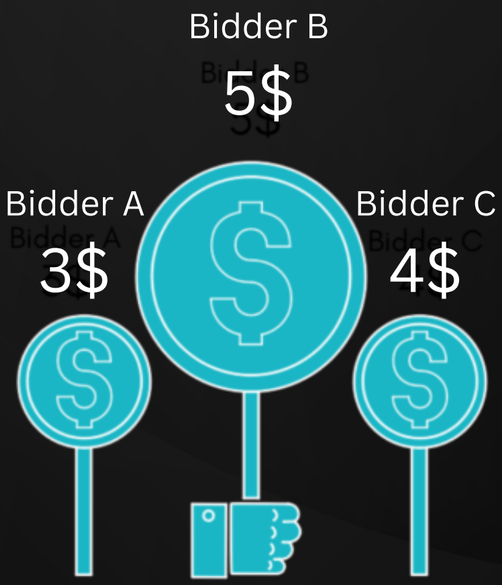
The first-price sealed-bid auction is a common type of auction used in various contexts, including online marketplaces, government procurement, and private sales. In this type of auction, participants submit their bids in secret, without knowing the bids of other participants. When the auction ends, the participant with the highest bid wins the item or the right being auctioned, and they pay the amount they bid.

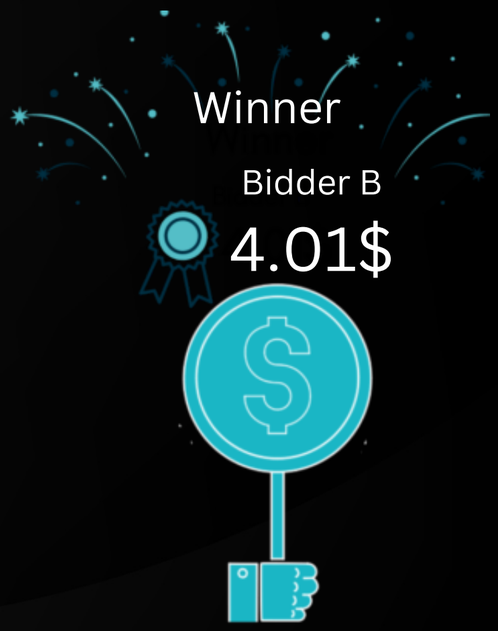


POOL B:

- **SEALED BID SECOND PRICE (VICKREY) AUCTION:**

A Vickrey auction or sealed-bid second-price auction (SBSPA) is a type of sealed-bid auction. Bidders submit written bids without knowing the bid of the other people in the auction. The highest bidder wins but the price paid is the second-highest bid.





Game-1 : Horse Bidding

(Based on FIRST-PRICE SEALED BID AUCTION)

Rules:

- There will be three tiers of horses : Tier 1 ,Tier 2,Tier 3 and 5 players in the game.
- Tier-1, Tier2 ,TIer3 will have 4 ,3, 1 horses/horse respectively
- There will be first-price, sealed-bid auction for the horses of each tier.
- Points Distribution for the horses of each tier:

  Tier 1- 50-60

  Tier 2- 30-40

  Tier 3- 1-10

- Each player has 1 lakh rupees.
- If two players has equal points at the end of last rounds then the player who has more money left with them will be the winner.

- Bidding rounds starts first with tier-1 horses and participants get their allotted horses, based on their bidding value . The last participant who is unable to win any of the horse of tier-I gets eliminated.
- In the second round as well the remaining 4 participants bid for the 3 horses with the money remaining with them after first round and similarly last participant gets eliminated. So in last round, three participants are left and similar bidding takes place and at the end of that round, the guy who has more points, wins the game.
- In case of same points , person with more money left will be the winner.

LINKS TO CODE AND DATA OBTAINED :

Google drive link for code: https://drive.google.com/file/d/1fYuBqG0iD9M2CdjnIEweVxvm-1pxJX0D/view?usp=sharing

Google drive link for spreadsheet of data obtained: https://docs.google.com/spreadsheets/d/1leHrNsuFwcxB-pcHrkBobp6qe97Ac5Ql-pS0N-BaBxQ/edit?usp=sharing

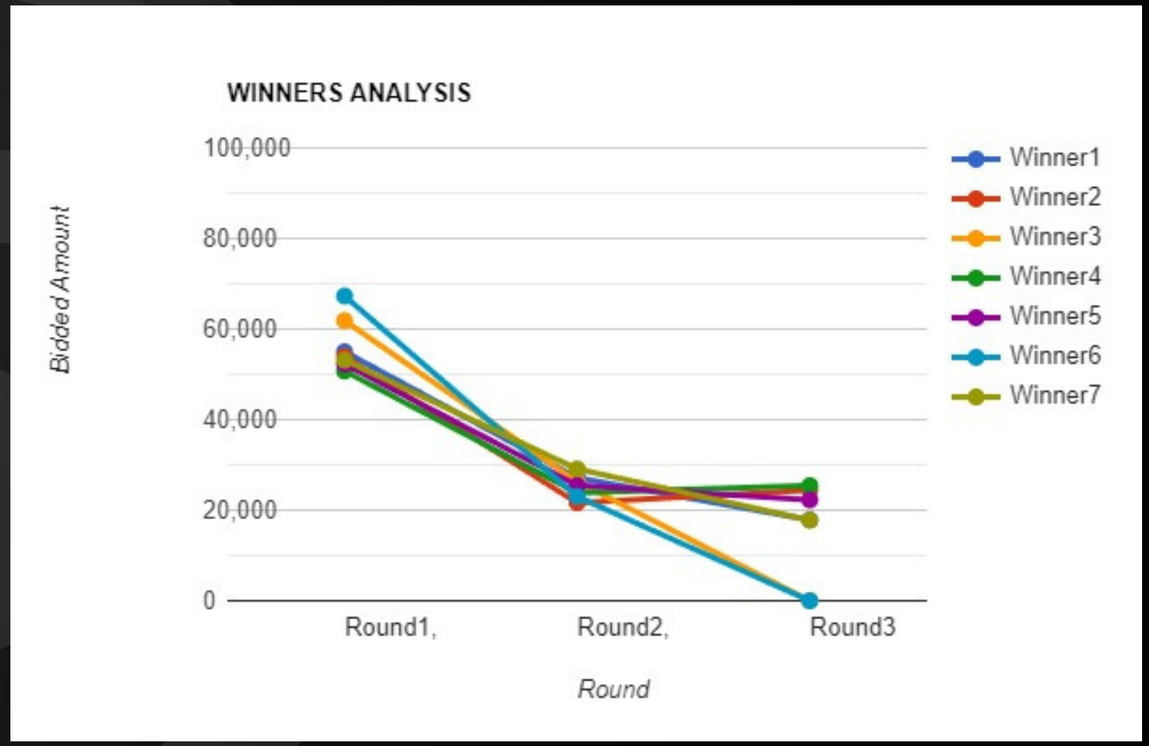
EXAMPLE

		Round 1	Round 2	Round 3	Remarks
1	Money	30521	5750	5750	
	Points	54	89	89	
2	Money	eliminated	eliminated	eliminated	Eliminated in round 1
	Points	eliminated	eliminated	eliminated	
3	Money	41055	17703	17703	
	Points	51	90	90	
4	Money	37550	eliminated	eliminated	Eliminated after round 2
	Points	58	eliminated	eliminated	
5	Money	45012	17855	0	
	Points	50	85	93	Winner

- After round 1 , 2nd person get eliminated because he/she hasn't bought any horse.
- After round 2 , 4th get eliminated because he/she hasn't bought any horse in round 2.
- In round three there is one horse to bid, so person with highest money left will get that horse so here person 5 is left with highest money so he got 8 points for the last horse . So overall person 5 got 93 points and he/she has highest points at last. So he/she is the winner.

BEST STRATEGY FOR GAME 1

- The Best Strategy to win this game is to bid highest (50,000 to 60,000) in round 1 as, more valuable points are up for grabs, and getting them can keep you in the game.
- Bidding higher in later rounds will not be as beneficial as the earlier option, because the points achieved will be significantly less.



Game 2:

- There will be 5 participants each given 1 lakh rupees.
- There will be three rounds in each game . The money each player bids will get deducted even if they are not the highest or second highest bidders.
- The bidder can bid atmost the money he/she left after each round.
- The bidder with the highest bid will get points equal in magnitude of the difference between the highest bid amount and second highest bid amount.
- Person with the highest points after three rounds will be the winner .

LINKS TO CODE AND DATA OBTAINED :

Google drive link for code:
https://drive.google.com/file/d/15_DUChegMzLk9_EYM8uKdiO-V_mTMFhE/view?usp=sharing

Google drive link for spreadsheet of data obtained:
https://docs.google.com/spreadsheets/d/18UksZrlTzyay4t43LEn5UR2BLPXLts3n7bwHkk8cpl0/edit?usp=sharing

Example:

	Player No.	Round 1	Round 2	Round 3
Money Left	1	83193	67122	0
Points		0	0	16149
Money Left	2	27575	10919	0
Points		0	0	0
Money Left	3	66153	50973	0
Points		0	0	0
Money Left	4	66191	27564	0
Points		0	21971	21971
Money Left	5	2510	1098	0
Points		25065	25065	25065

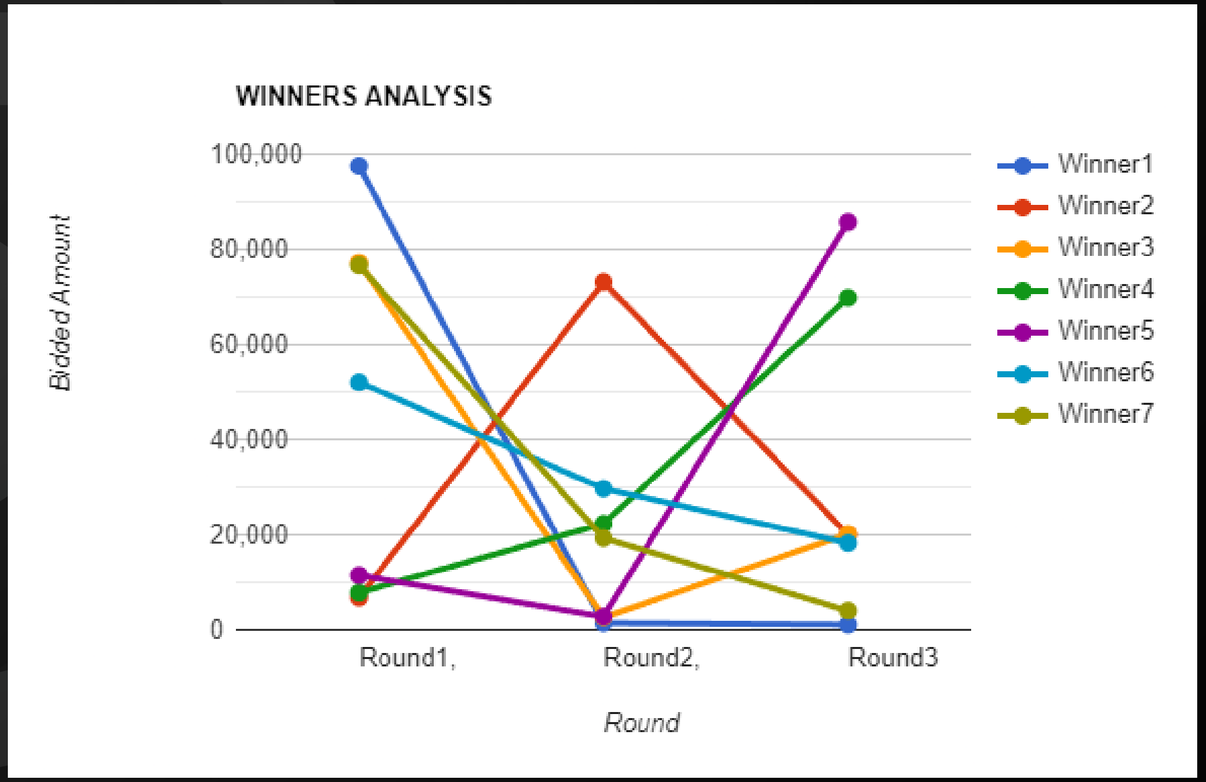
- Here player 5 bid the most amount and player 2 bid the second highest amount in round 1. So player 5 gets points (97490-72425) = 25065 .
- Now in round 2, player 4 has bid the highest amount and player 2 has bid the second highest amount so player 4 gets points ((66191-27654)-(27575-10919)) = 21971.
- Then in similar way player 1 gets 16149 points in round 3.
- So in the end, player 5 has highest points so he/she is the winner.

BEST STRATEGY FOR GAME 2 :

We observed from our dataset that if we bid most of our money in round 1 or round 3 then it is highly probable that we get most of the points but it also depends on others how they react in each round .

Either we can wait for round three and observe that how much money is invested by other players also it has some risk like other players are also thinking the same. Then in round 3 no one get more benefit and person who bid more in round 1 may win .

So it is equally probable that the person who invest more in round 1 may win or person
who is waiting for round 3 may win.



Outcome and Conclusion :

From this project, we understood the essence of Game Theory through the two games. Both of the games gave us a good understanding that how decisions of others can effect our results.

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THANK YOU