

Finance and Economics Club

Finance Tech Camp



# Game Theory

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# ABOUT

This project involves fundamentals of any research work, experimentation and of course, game theory.

## WHAT IS GAME THEORY?

Game theory is the study of mathematical models of strategic interactions among rational decision-makers. It has applications in all fields of social science, as well as in logic, systems science and computer science.



I use game theory to help myself understand conflict situations and opportunities

~Thomas Schelling

Applying Game Theory to Everyday Life. Game theory can be used to analyze negotiation and bargaining situations, such as salary negotiations, business deals, or diplomatic discussions.

In finance, game theory can be used to model competition between companies. For example, game theory can be used to analyze how companies react to price changes or whether a company should acquire another. Game theory can also be used to analyze how investors react to stock market developments and the decisions of other investors.



**The economic approach is applicable to all human behaviour."**

**-Gary S. Becker**

# Auction Theory

AUCTIONS ARE INTRIGUING SOCIAL EXPERIMENTS  
THAT REVEAL THE COMPLEX INTERPLAY OF  
INFORMATION, INCENTIVES, AND HUMAN BEHAVIOR."

- SUSAN ATHEY

An auction is a system of buying and selling goods or services by offering them for bidding—allowing people to bid and selling to the highest bidder. Auction theory can be approached from different angles - from the perspective of game theory auctions are Bayesian games of incomplete information. Auctions are used in various contexts, including selling goods and services, allocating resources, and even in online advertising. Prominent auction formats include-

1. English Auctions
2. Dutch Auctions
3. Vickrey (Second-Price) Auction
4. Sealed Bid (First-Price) Auction



# FIRST SEALED BID

In a first-price sealed-bid auction, each bidder submits a sealed bid to the seller (that is hidden from other bidders). The high bidder wins and pays his bid for the good. It is obvious that in a first-price sealed-bid auction, a bidder always bids below her valuation for the item. If she bids at or above her value, then her payment equals or exceeds her value if she wins the auction, and therefore her expected profit will be zero or negative. Since bids are below bidders' values, the first-price sealed bid auction is not a demand revealing mechanism.



# VICKREY(SECOND) SEALED BID



In a Vickrey, or second price, auction, bidders are asked to submit sealed bids  $b_1, \dots, b_n$ . The bidder who submits the highest bid is awarded the object, and pays the amount of the second highest bid.

In such an auction, individuals are encouraged to bid their maximum willingness to pay. In the absence of collusion, there is no incentive for an individual to bid higher or lower than their maximum willingness to pay.



A dramatic chessboard scene with a candle and a checkered pattern.

GAME 1

AKBAR-BIRBAL

FIRST SEALED BID

# SCENARIO :

Once Akbar was very impressed by his Gems (councilman). He wanted to gift them gold coins and Rubies. But at the same time he also wanted to know who is smartest of them. He was very impressed by Birbal 's Intellect. So , he came up with a game to test him. Next day, he called his 3 smartest gems and Birbal. And told them that they are going to play a game. There will be 5 rounds and in total there will be 4 players.. Every round will have some pre- determined price which consist of Gold coins and Rubies. These Prizes will be revealed Before the start of each round. Every player will write what he wants on piece of paper and give it to Akbar. But the Bids should be unique.

# AIM:

Winner will be the person who has atleast one ruby and maximum no. of gold coins. If no one gets a ruby, then none will win.

So are you ready to be Akbar's Birbal



# RULES:

1. If 2 players wrote the same thing, then none will get it.
2. If everyone bid for different thing, then everyone will get what they want.
3. After every round, Akbar will announce who got what they wanted(means had unique bid), but won't tell what they won.

*The prices of the rounds are as follows:*

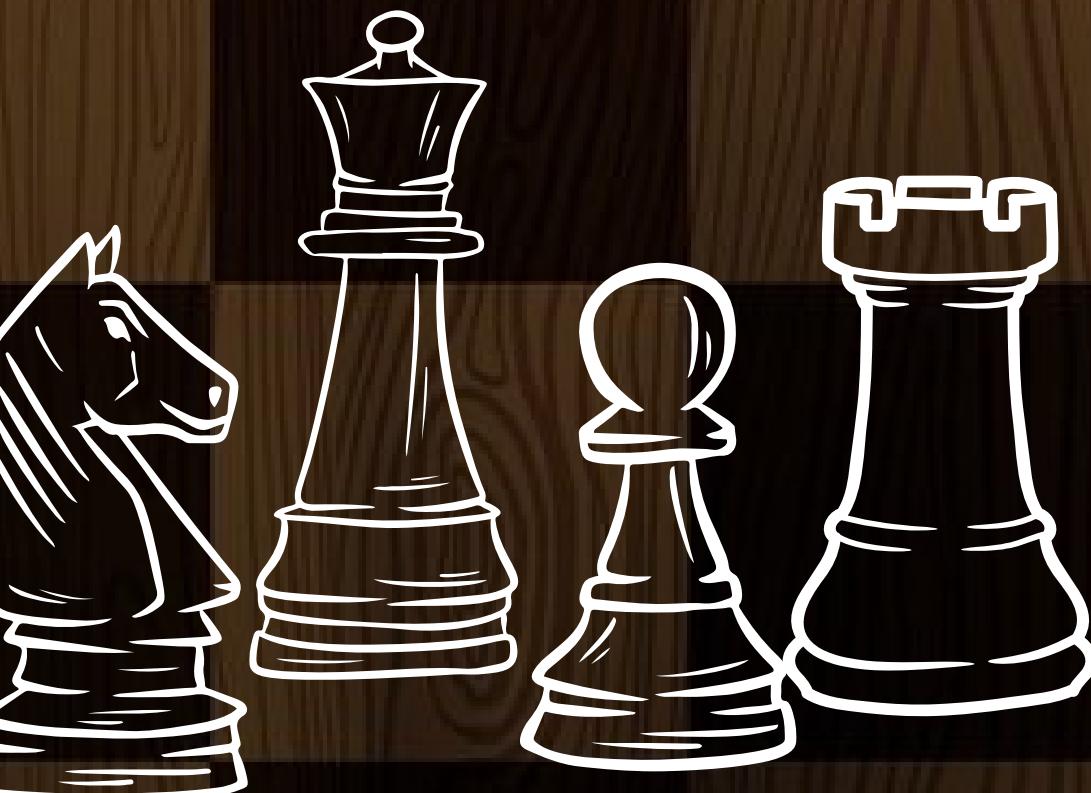
*Round 1 : R1 , 100 , 50 , 75 , 25*

*Round 2 : 100 , 75 , 25*

*Round 3: 500 , 250 , 125 , 100*

*Round 4: R1 , R2 , 333 , 666 , 133*

*Round 5: R1 , 1000, 80*



# OUTCOME ANALYSIS:

1. Assess the value of each item: Before each round, take a look at the available items and determine their overall value. It is important to bid on an item that has a higher value than what the other players may bid on.
2. Know when to bid for a Ruby: Rubys are crucial as they guarantee at least one Ruby for the overall win. However, don't bid too high on Rubys and risk losing out on the cash prizes in other rounds. Players should aim to bid on Rubys that are likely to be less popular among other players.
3. Aim for the highest cash value: In rounds where no Ruby is available for bid, always aim for the highest cash value available. This helps to increase your overall cash amount and thereby your chances of winning.
4. Keep track of opponent's bids: Keep track of the bids of other players in each round.

# STRATEGY WE RECOMMEND:

1. In rounds where there is a Ruby up for bid, players should prioritize bidding on the Ruby as it guarantees at least one Ruby for the overall win. Try to win a Ruby as soon as possible.
2. In rounds where there is no Ruby up for bid, players should aim to bid on the highest cash value available to increase their overall cash amount.
3. Players could also try to bid strategically by seeing their opponents' bids that whether they are winning or not. And aiming to outbid them while keeping their own bids reasonable.
4. In the final round, players with high cash amounts should aim to bid on the highest cash value available or potentially bid on the unique item (Ruby R1 or 80) to increase their chances of winning with a unique bid.
5. *If you win a ruby , then try avoid winning that because we just need one ruby for winning. And winning an extra Ruby is pointless.*

# A LOOK AT THE DATA



[https://docs.google.com/spreadsheets/d/1fFZhU1PU96\\_E1abbTyN3nL8zOzTkeTJhv9yCMpZ4ME/edit#gid=1023996792](https://docs.google.com/spreadsheets/d/1fFZhU1PU96_E1abbTyN3nL8zOzTkeTJhv9yCMpZ4ME/edit#gid=1023996792)

As we can see that our strategy has a  
Success Rate of 4/5

Success rate was decided by randomly removing a player from a game data set and playing according to our strategy

GAME 2

LET'S GET A NEW  
CAMPUS  
SECOND SEALED BID

# SCENARIO:



IIT GUWAHATI is putting out some tenders for construction and development. You are a contractor and have to place bid to get the contracts.

3 major things to consider

1. Reserve capital: The amount you need to start the work.
2. Cost: Actual cost after finishing the project.
3. The total amount of money each player has at the start of game i.e. is 30 lakhs.

There will be in total 5 bids

# AIM:

To earn the maximum profit percentage. (Meaning if you invested 10 lakhs(cost) and earns 1 lakh but someone invested 8 lakhs and earns 90K then he will be the winner)

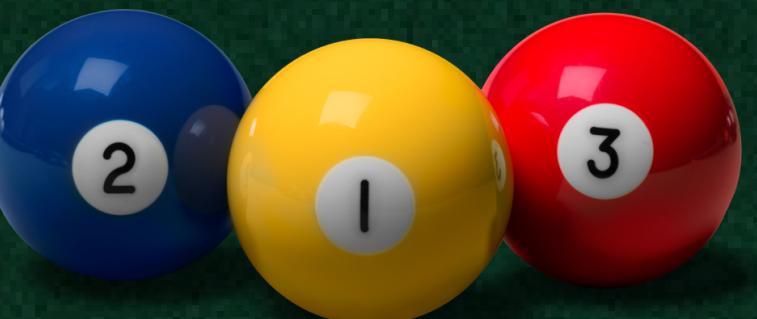
# RULES:

1. A person can't get more than 2 deals.
2. If you get a deal of Reserve say 12 lakhs and next deal comes for 22 lakhs Reserve you won't be able to bid for it.
3. It's a second sealed bid, meaning the person with lowest bid will get the deal but at the quotation price of the 2nd lowest.
4. In Case of tie at the end winner will be decide by the profit amount.

# GENERAL KNOWLEDGE:

There will be 5 bids

- 1 of tier A
- 2 of tier B
- 2 of tier C
  - Tier A bid will have require a Reserve of more than 20 lakhs
  - Tier B will require more than 10 lakhs
  - Tier C will require less than 10 lakhs



# FOLLOWING ARE THE TENDERS



TENDERS	RESERVE AMOUNT	COST AMOUNT
BASKET BALL COURT	14 LAKHS	10 LAKHS
SQUASH COURT	8 LAKHS	5 LAKHS
SWIMMING POOL	22 LAKHS	14.5 LAKHS
ATHLETICS GROUND	5.5 LAKHS	3 LAKHS
MEN'S GYM	16 LAKHS	12 LAKHS

# OUTCOME ANALYSIS

- Your strategy for the tender bid game appears to prioritize securing tenders with a minimum profit margin of 9% or above while considering the tier of the project and the bidding behavior of competitors. Here's a breakdown of your strategy:
  - Tier Selection: Target tenders in either Tier A or Tier B, with a preference for projects at the edge of your options. Smaller projects may have less competition and allow you to bid with a smaller margin of loss.
  - Small Margins of Loss: Be willing to bid with a very small margin of loss to win tenders. This approach can make your bids more competitive and increase your chances of securing projects.

- Profit Maintenance: Once you've secured a tender with a profit margin of 9% or higher, focus on maintaining that profit margin. Avoid taking additional tenders that would result in losses, even if they have no profit margin. Prioritize profitability over expanding your project portfolio.
- Early Bidding Advantage: Recognize that early in the game, competitors may not be desperate for tenders, and the margin strategy might not be immediately apparent to them. Use this advantage to secure tenders with good profit margins.
- Tier C Tenders May Be More Profitable: Based on your observation, Tier C tenders may be more profitable due to lower capital requirements and the tendency of people to bid based on absolute amounts rather than profit percentages. Consider targeting Tier C tenders when implementing your strategy.
- Risk Management: While bidding with small margins of loss, always consider risk management. Ensure that you can absorb potential losses without jeopardizing your overall strategy.

# STRATEGY TAKE WE RECOMMEND:

- Try to Get the first Bid with either cost to cost bid or a bit of loss as at point players bid with maximum profit to get the feel of the game
- Avoid the Tier A as the reserve required for it is the largers and will take more 70% of the reserve which is not a good deal if u dont take a profit of atleast 15% to Ensure our win.
- Avoid bidding in loss/ cost to cost for last 2/3 as people tends to aggressive and bid lower to atleast get a bid.
- After getting first bid, place your bid according to that bid's Returns. Try just a bit lower then that to ensure your profit percentage does not get your by alot.

# A LOOK AT THE DATA

[https://docs.google.com/spreadsheets/d/1fFZhU1PU96\\_E1abbTyN3nL8zOzTkeTJhv9yCMpZ4ME/edit#gid=1023996792](https://docs.google.com/spreadsheets/d/1fFZhU1PU96_E1abbTyN3nL8zOzTkeTJhv9yCMpZ4ME/edit#gid=1023996792)

As we can see that our strategy has a  
Success Rate of 3/5



Success rate was decided by randomly removing a player from a game data set a playing according to our strategy

# Team Name : Let's play

## Team Members:

- Ananya Singh
- Arin Gupta
- Sitesh K. Goyal

Thank You