# Introduction

The primary goal of this project is to explore and demonstrate the capabilities of Large Language Model (LLM) based agents within multiagent systems. Specifically, we have simulated a Dutch auction, a type of auction where the price starts high and drops until a participant accepts the price, to evaluate these capabilities. The simulation is executed using OpenAI’s language model and features one auctioneer along with three participating agents.

# Approach

## Communication Structure

The communication within this simulation adheres to a simple yet effective structure. Initially, the auctioneer agent broadcasts a message to all participants. Following this, each participant agent sequentially responds, a process facilitated by single-threaded operation. These responses are collected and managed by a helper manager agent which organises the flow of information back to the auctioneer agent for further action.

## Communication Act

The Auctioneer Agent is restricted to responding in the following template, here is an example.

<name>: ‘John’

<message>: ‘The auction will start at {amount}

<ask price>: ${amount}

Participants are programmed to respond in one of two predefined manners to maintain consistency and predictability within the simulation:

<name>: Not placing a bid

OR  
<name>: Placing a bid of ${amount}

This structured approach is essential to prevent simulation divergence due to unpredictable input variations.

## Negotiation Protocol

The protocol mirrors the traditional Dutch auction format. If no bids are placed, the auctioneer lowers the asking price. This process repeats until a bid is placed, upon which the item is sold to the bidder offering the highest price at that moment.

# Results

For a detailed examination of the simulation outcomes, please refer to the ipynb file available in my github repository.

# Reflection

Initially, the simulation was attempted using Langchain, but inconsistencies in their documentation and agent module outputs led to challenges. A switch to OpenAI’s chat completion module significantly improved the simulation's consistency and reliability