

Additional Experiment

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1 Introduction

In additional experiments within the NegotiationArena benchmark[Bia+24], we explore the dynamics of price negotiation between a buyer and seller over a good. The environment simulates real-world bargaining scenarios where both parties have their own strategic goals and constraints. This setting tests the negotiation skills of AI agents, evaluating their ability to make decisions, adapt strategies, and ultimately reach a mutually beneficial agreement. The outcome of these games provides insights into the agents' capability to understand and interact within complex negotiation frameworks.

In the NegotiationArena, we simulate price negotiations to study LLM agents' bargaining skills. This involves setting a predefined price (pre-policy) for goods, where this fixed price is a strategic decision communicated to the seller. It's rational for the seller to respond to this set price by either accepting or rejecting the deal. To evaluate the effectiveness of a pre-policy, we take the dealt price as metric, and compare with the baseline without any intervention (the basic setting of the game).

2 Experiment Details

We initiated our experiment with a pre-policy start price of 50 ZUP and observed how agents adapt to various aspects, such as seller behavior and negotiation duration. For instance, a quick deal in the previous round suggested the seller's satisfaction, prompting us to propose a lower price in subsequent rounds until the seller declined.

Our simulations, depicted in Figure 1, demonstrate the pre-policy generator's ability to refine its pricing strategy dynamically, securing deals at prices lower than the average of 46 ZUP without intervention, approaching the product's cost of 40 ZUP.

In the experiment within NegotiationArena, a typical round of simulations with pre-policy intervention demonstrates the buyer's strategy to propose a fixed trade of 41 ZUP, communicated to the seller. Upon observing the pre-policy, the seller responds and ultimately accepts the offer. This interaction showcases the pre-policy generator's ability to adaptively adjust the pricing

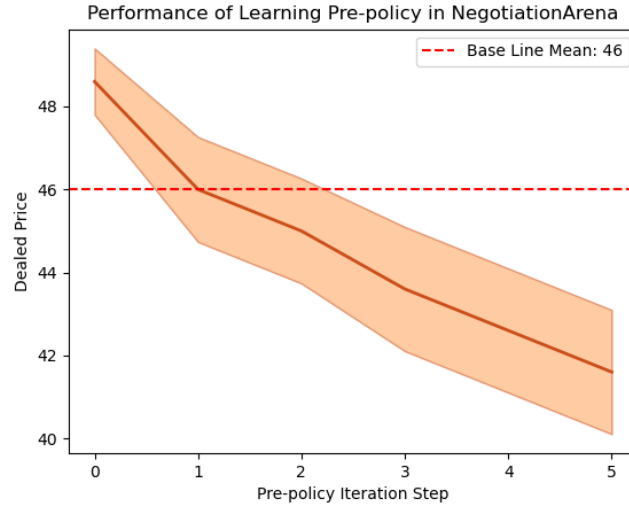


Figure 1: Pre-policy in NegotiationArena

strategy, influencing the negotiation outcome favorably towards the buyer, as depicted in Figure 2. This scenario illustrates the effectiveness of pre-policy interventions in guiding negotiations towards desired outcomes.

Pre-policy Iteration: Given that the last price agreed upon was 43 ZUP and considering the buyer’s strategy of never changing their offer and ignoring anything said by the seller, the best course of action for the buyer would be to:

- Lightly Decrease (-1 ZUP) the price

This strategy aligns with the buyer’s firm stance throughout the negotiation. Since the average deal price without pre-policy intervention is around 46 ZUP and the buyer’s last accepted offer was at 43 ZUP, a slight decrease will test the seller’s flexibility while still remaining below the average deal price threshold. It is also likely that the seller has no option but to accept the buyer’s price due to the buyer’s negotiating strategy of not changing the offer.

Hence, my recommendation for the buyer’s next move is to ‘lightly decrease’ the price.

Buyer’s Proposed Trade: Seller Gives X: 1 — Buyer Gives ZUP: 42

Buyer’s Reason: Continuing to adhere to the strategy, I will ignore the seller’s messages and counterproposals and will only propose a trade of 42 ZUP.

Seller Response: I have considered your position and understand the value you see in the object at your proposed price. I am willing to accept your offer of 42 ZUP for the object. Let’s proceed with the trade.

Figure 2: Interaction between Seller and Buyer With a Pre-policy

References

- [Bia+24] Federico Bianchi et al. “How Well Can LLMs Negotiate? Negotiation-Arena Platform and Analysis”. In: *arXiv* (2024). eprint: 2402.05863.