# Artificial Intelligence Project Report

**Gomoku AI Game (15x15 Board)**
**2024/2025**

## Overview

This project is a turn-based strategy game (Gomoku) implemented in Python using Pygame for the GUI and the Minimax algorithm (with Alpha-Beta pruning) for the AI opponent. Players alternate placing pieces on a 15x15 board, trying to be the first to align 5 in a row vertically, horizontally, or diagonally.

## Game Modes

- Human vs Human

- Human vs AI (Minimax algorithm)

## AI Logic

- Minimax Algorithm with Alpha-Beta Pruning
- Dynamic Depth Adjustment based on game progress
- Move Ordering prioritizes strategic and center cells
- Evaluation Function considers:
  - Threat levels
  - Open-ended sequences
  - Positional advantages

## Code Structure

| File | Description |
|---|---|
| main.py | Entry point – runs the game loop using asyncio |
| gomoku_board.py | Board logic, move validation, win checks, and AI class |
| game_manager.py | Manages turn-based flow and handles input/events |
| game_ui.py | GUI rendering using Pygame |

## Technologies Used

- Python 3.10+
- Pygame
- Git + GitHub

## Team Members & Contributions

- Mohamed Elsefi:  gomoku_board.py  + Documentation
- Zeyad Ibrahim:  gomoku_board.py  + Documentation
- Amr Elsayed: game_manager.py
- Kareem hany: game_manager.py
- Mohamed Selem:  game_ui.py + main.py + README
-Mohamed Ahmed:  game_ui.py + main.py + README

## Challenges Faced

- Optimizing Minimax speed for a large board (15x15)
- Designing intuitive UI
- Balancing AI difficulty and performance

## Conclusion

This project demonstrates a complete implementation of an adversarial game using Minimax with Alpha-Beta pruning and a full graphical interface. All team members contributed to the repository.

## GitHub Repository

https://github.com/ELSEFI/Game-by-PY-Gomoku-Game-