Artificial Intelligence

2024/2025

Course Project – Adversarial Search (25 Points)

In **Lab 06**, you've explored a different branch of search strategies known as **Adversarial Search**, which is particularly relevant in competitive environments like **games**. The lab introduced you to the concept of adversarial search where _agents make decisions in the presence of opponents_, each trying to _maximize their own outcome while minimizing the other's_. You learned about key environment properties that affect such search problems, including _the nature of two-player games, turn-based interactions_. The focus was on the **Minimax algorithm**, a foundational approach in decision-making for adversarial scenarios. Through the **implementation of a Tic-Tac-Toe game**, you applied the Minimax strategy to evaluate possible moves, simulate outcomes, and determine the optimal move at each step. This hands-on exercise helped reinforce the logic behind adversarial decision-making and provided a deeper understanding of how AI can act strategically in competitive environments.

- **You are required to form a team consisting of <u>4 to 6 Members only</u> with the same Instructor you are attending to.**

(مفيش أى استثناءات ، أصل صحابى فى السكشن الفلانى ... أصل عايز الدحيح معايا)

- **As a team, you are required to Design a game as <u>the instructions below</u>, which contains an AI agent that humans can compete, using one of the Adversarial search strategies.**

- ### Project Methodology and Implementation - *(13 Points)*
    The team should choose one of these games (**Connect 4, Chess, Checkers, Othello**), only **Tic-Tac-Toe is not allowed**. If there is any other ideas you would like to implement, just discuss them with the _Instructor_ before going to do it.

    ➢ Design the environment of the game with interfaces to interact with - *(5 Points)*
    ➢ Validate any wrong inputs that comes from the user – *(2 Points)*
    ➢ Make the game playable either by Human or computer – *(2 Points)*
    ➢ Implement MinMax Algorithm to provide AI competence to the game – *(3 Points)*
    ➢ Provide a full clean-code with <u>no redundancy</u> using classes and functions – *(1 Point)*

- **Project Tracking –** *(4 Points)*

  In order to guarantee a perfect delivery of the project, and fair grading for all team members. The team should provide ***GitHub Repository*** which all members participate and contribute to it. The link of the Repo will be provided with the team registration.

  - ➢ The project should be divided into *submodules*, each submodule can be made by one student of the team, and it will be as contribution – ***(2 Points)***
  - ➢ Each student should contribute to the project through the Repository on github, the instructor will track every team – ***(2 Points)***

- **Project Documentation and Delivery –** *(8 Points)*

  The team should organize its work and document every single detail of the project in well-organized and well-detailed documentation. Then, proceeding to the discussion of the project.

  - ➢ A well-detailed documentation with illustrations showing steps of the implementation of the project – ***(5 Points)***
  - ➢ In the *Project Discussion*, each student should prove his understanding of all aspects of the project that the team implemented – ***(3 Points)***

- **Optional Bonus Tasks –** *(15 Points)*

  These tasks are **optional** for the team, if it is implemented in the correct way, whether **one of them or all**, then all team members will get the points of the bonus task based on the following:

  - ➢ Implement a well-designed ***Graphical-User Interface (GUI)*** for the game using Python. Where you can use any framework of your choice – ***(5 Points)***
  - ➢ Use ***any other adversarial search*** than MinMax Algorithm – ***(5 Points)***
  - ➢ ***Optimize*** the algorithm as much as possible for faster performance – ***(5 Points)***

Good Luck 😊

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