

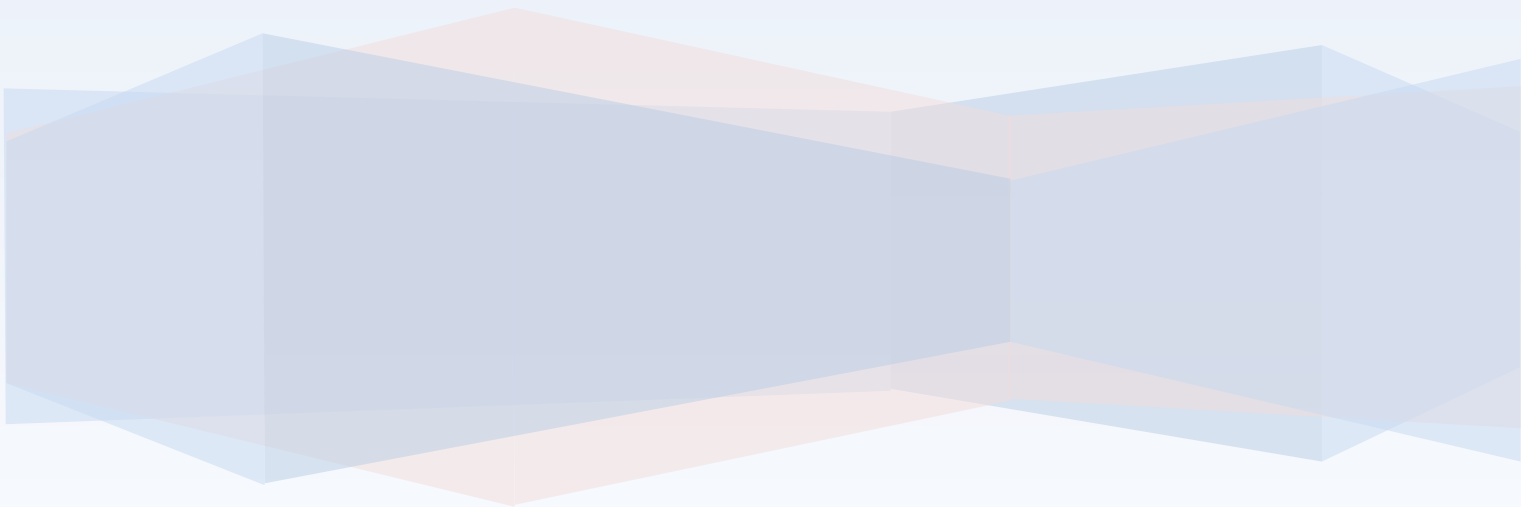
# COS30002 Artificial Intelligence for Games

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*Semester 1, 2023*

*Learning Summary Report*

Tran Duc Anh Dang - 103995439



# Declaration

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I declare that this portfolio is my individual work. I have not copied from any other student's work or from any other source except where due acknowledgment is made explicitly in the text, nor has any part of this submission been written for me by another person or software service.

Signature: Tran Duc Anh Dang

A black and white image of a handwritten signature. The signature is written in a cursive style, starting with a large, stylized 'T' and ending with a long, sweeping horizontal stroke that curves upwards at the end.

## Self-Assessment Details

The following checklists provide an overview of my self-assessment for this unit.

	Pass (P)	Credit (C)	Distinction (D)	High Distinction (Low HD)   (High HD)	
Self-Assessment (please tick)		✓			

### Self-assessment Statement

	Included? (tick)
Learning Summary Report	✓
Complete Pass ("core") task work, approved in Canvas	✓

### Minimum Pass Checklist

	Included? (tick)
Additional non-core task work (or equivalent) in a private repository and accessible to staff account.	✓
Spike Extension Report (for spike extensions) in Canvas	✓
Custom Project plan (for D and/or low HD), and/or High HD Research Plan document in Canvas (optional)	

### Credit Checklist, in addition to Pass Checklist

	Included? (tick)
Custom Project Distinction Plan document, approved in Canvas	
All associated work (code, data etc.) available to staff (private repository), for non-trivial custom program(s) of own design	
Custom Project "D" level documents in Canvas, to document the program(s) (structure chart etc) including links to repository areas	

### Distinction Checklist, in addition to Credit Checklist

	Included? (tick)
Custom Project "HD" level documents in Canvas, to document the program(s) (structure chart etc) including links to repository areas	

### Low High Distinction Checklist, in addition to Distinction Checklist

	Included? (tick)
High Distinction Plan document, approved in Canvas	
High Distinction Report document, in Canvas, which includes links to repository assets	
All associated work (code, data etc.) available to staff (private repository) for your research work	

### High High Distinction (Research) Checklist, in addition to D/Low HD Checklist

## Introduction

This report provides a comprehensive overview of my learning journey throughout the COS30002 Artificial Intelligence for Games unit. It includes a self assessment against the set criteria as outlined in the unit outline, an explanation of the pieces included in my portfolio, an account of how I achieved the intended learning outcomes of the unit, and a reflection on my learning experience.

## Overview of Pieces Included

This section outlines the pieces that have been included in my portfolio. Each of these pieces has been selected to demonstrate my understanding, and growth in various aspects of AI for Games.

1. Tic Tac Toe AI Battle: This project demonstrates my understanding of software development techniques for game AI, specifically the application of a min-max algorithm.
2. Lab "Graphs, Paths & Search" and Spike "Navigation with Graphs": These labs and spikes allowed me to explore and apply graph based path planning techniques, enhancing the navigation behaviour of AI within game environments.
3. Lab "Steering 1- Seek, Arrive, Flee": This lab offered me the chance to apply different steering behaviours to simulate realistic agent movements within games.
4. Spike 15 "Goal Oriented Action Planning (GOAP)" Extension: This extension was crucial in displaying my proficiency in developing goal-oriented AI agents capable of handling complex decision-making scenarios.
5. Spike "Tactical Analysis with PlanetWars" and "Tactical Steering (Hide!)": In these spikes, I combined different AI techniques, illustrating my ability to integrate various AI strategies for advanced game design.

## Coverage of the Intended Learning Outcomes

This section outlines how the pieces I have included demonstrate the depth of my understanding in relation to each of the unit's intended learning outcomes.

### ILO 1: Software Development for Game AI

- For this ILO, my extension report specifically demonstrates my understanding of software development techniques for Game AI through the application of a min-max algorithm in Tic Tac Toe A.I Battle. This is a prime example of how the theoretical understanding of AI algorithms can be used in practice for the development of a game.

### ILO 2: Graphs and Path Planning

- In Lab "Graphs, Paths & Search," I explored the relationship between nodes and edges in a graph, applied pathfinding algorithms, and learned about their implications in game development. This was expanded in the Spike "Navigation with Graphs," where I introduced environmental obstacles and made the blocks in the game deal damage, offering new challenges and strategies for the AI. I also added two search algorithms - A\* and Dijkstra, to enhance AI navigation.
- In the Spike "Navigation with Graphs," you applied graph-based path planning techniques to enhance the enemy's navigation behaviour. The Enemy class in enemy.py incorporates graph-based pathfinding algorithms to enable the enemy to follow a path from its current position to a specified destination when on mode 'follow path'.

### ILO 3: Force-based Agent Movement

- The Lab "Steering 1- Seek, Arrive, Flee" gave me the opportunity to apply various steering behaviours to simulate realistic movements. This contributed to creating more believable and dynamic characters within game environments.
- Later on, when I'm developing Agent class or Enemy class, these movement have been improving by adding more force based agent movement techniques. By calculating and applying steering forces based on the current mode of the agent (e.g., attack, wander or follow path), I was able to create agents that navigate their surroundings in a more intelligent manner. The calculate() method either the Agent or Enemy class determines the appropriate steering force based on the agent's mode, and the update() method applies the calculated force to update the agent's position and orientation.

### ILO 4: Goals and Planning Actions

- In the Spike 15 "Goal-Oriented Action Planning (GOAP)" extension, I expanded the system by introducing additional goals and actions for the agents. Furthermore, you incorporated different agent types, each with varying abilities and strategies, to showcase the versatility of the goal-oriented approach. Additionally, you integrated environmental obstacles and created a dynamic world that evolves over time. These additions required the agents to continually adapt their plans and decision-making processes.
- By implementing a goal-oriented behaviour system and enhancing it with GOAP, I demonstrated mine proficiency in designing and developing intelligent agents that can autonomously handle complex decision-making scenarios. Your ability to incorporate diverse goals, actions, and adaptability into the system showcases your expertise in creating more sophisticated and dynamic AI behaviour for game development.

### ILO 5: Combine AI Techniques

- Throughout the course, I have consistently combined various AI techniques for advanced game AI. For instance, in the Spike "Tactical Analysis with PlanetWars" and "Tactical Steering (Hide!)," I combined AI strategies, path planning, and steering behaviours for complex AI behaviour. In Spike 16 "Navigation with Graphs," I integrated features like damage-inflicting blocks and the switch to a wander mode when not being guided, enhancing the complexity and dynamism of the game environment.

By combining these various techniques, I have developed a strong foundation in AI game development, demonstrating my ability to use and integrate different AI strategies for more advanced game design.

Additionally, in the agent.py and enemy.py scripts, I implemented various AI functionalities. The agent.py script handles the behaviour and movement of the player agent, incorporating path following, wandering, and separation from nearby agents. The enemy.py script defines the behavior and movement of enemy

AI, including wandering, following paths, collision detection with health and shield objects, and damage calculation. These scripts demonstrate my practical implementation of AI techniques within game development, showcasing my ability to create dynamic and engaging AI-controlled characters in virtual environments.

## Reflection

### The most important things I learnt:

- Throughout this course, I gained a significant understanding of AI in gaming. Key learning points included the use of the min-max algorithm in game development, the integration of graph-based path planning techniques, the application of force based agent movement, and the implementation of goal oriented action planning. I also learnt the importance of combining these AI techniques to create more engaging and dynamic games. This learning experience expanded my expectation and provided me a clear perspective on the roles and potentials of AI in game development.

### The things that helped me most were:

- The lab exercises were particularly beneficial in my learning. They provided practical examples and problems that helped me to understand the concepts and apply the AI techniques. Feedback from tutors and group discussions also helped me to clarify my doubts and extend my understanding of the subject matter.

### I found the following topics particularly challenging:

- Though the implementation of goal oriented action planning (GOAP) and the combination of different AI techniques were quite challenging, they also provided me with a profound sense of achievement once I was able to understand and implement them correctly.

### I found the following topics particularly interesting:

- I was particularly fascinated by the application of force based agent movement in games. This topic gave me a new perspective on how to create more realistic and dynamic characters within game environments.

### I feel I learnt these topics, concepts, and/or tools really well:

- I gained a deep understanding of software development techniques for Games AI, graph based path planning, force based agent movement, and goal oriented action planning. The application of these techniques in various lab works has solidified my knowledge.

### I still need to work on the following areas:

- I need to further refine my skills in integrating different AI techniques for more advanced game design. While I have gained a fundamental understanding, I believe there's always room for improvement and fine tuning.

### My progress in this unit was ...:

- Even though I was working and studying overseas in the last 2 weeks of the semester, I believe I still made consistent and steady progress throughout this unit. I maintained regular submissions of my work and actively engaged with my tutor, which greatly influenced my learning and final grade.

### This unit will help me in the future:

- The knowledge and skills acquired in this unit will be incredibly beneficial in my future studies and career. Understanding AI techniques and their applications in game development will provide me with a competitive edge in the growing gaming industry.

### If I did this unit again I would do the following things differently:

- Given my current experience of juggling both an internship as an AI engineer and my studies, I now understand the importance of effective time management and prioritizing tasks. I would apply these skills by starting lab work earlier, allowing more time to work through the complexities of the code as well as planning for custom projects and research for higher grade.

## Conclusion

In summary, I believe that I have clearly demonstrated that my portfolio is sufficient to be awarded a Credit grade. Through the careful completion of labs and a few extensions, I have met each intended learning outcome and shown a deep understanding of AI for games. My work in this unit has not only given me a broad foundation in game AI but has also instilled an eagerness to learn more about this exciting field.