IGB383 AI for Games

Assignment 1

An Exploration of Reactive Agents using FSM

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| **Assessment Overview** | |
| **ITEM:** | **Assignment 1: An Exploration of Reactive Agents using FSM** |
| **WEIGHTING:** | 30% (25% for Part A and 5% for Part B) |
| **OBJECTIVES:** | Unit Objectives 1, 2, 3 & 4 from unit outline |
| **DUE DATES:** | Friday 31st March 2023 (Week 5) |
| **DESCRIPTION:** | This is an individual assignment. Your deliverable for this assignment will be in two parts archived into a single .**zip** file and submitted via the **Blackboard Assignment System**:   1. A practical component. 2. A written component.  Part A – Practical Component For this part, you can use the Unity base given to you on Blackboard. You will write your code in C#. You **must** save and submit this part of your assignment as a **project folder**.  **Development Features**: This parts will focus on the following development features:   * 1. Creating reactive NPC agents that respond to a given set of Triggers and Place Markers.   2. Implementation of Finite State Machine (FSM) for the reactive agents.   3. Path finding using the Greedy and A\* search algorithms.   **Note:** A large portion of this assignment will be developed during workshops! It is advisable that you attend your workshops in order to complete the material with minimal issue. Part B – Written Component In this part of the assignment, you will each write a short report that outlines your understanding of the search algorithms used in path-finding and different FSA. There is no word limit, but your document should fulfil the requirements in the CRA for this assignment. |
| **CONTENT:** | You will submit via Blackboard in a .**zip** file (not .rar, .tar, .iso, .jar or any other archiving format) the following items:   1. The project folder in answer to part A 2. A .txt file of your scripts (in case something goes wrong with the project folder) 3. The short report in answer to part B. 4. The criteria sheet for this assignment. |

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| **FORMAT:** | Part B: Short report should have the following sections:   1. **Title page**: Your name, student number and unit code (some students are postgraduates) 2. **Statement of Completeness**: What was/was not completed in the assignment. 3. **Path Finding**: A section where you discuss path finding using the Greedy and A\* search algorithms. 4. **Finite State Machines**: A section where you discuss the FSA that you used in creating your NPC policies. 5. **Conclusion**: A summary of what you have learned.   Hint: Diagrams in your discussions will go a long way in conveying your understanding in sections c and d. |

# Requirements

In this assignment, you will develop a prototype of a top down point and click game. The NPC will be reactive agents controlled by Finite State Machines (FSM), able to perform some basic tasks assigned to each state. That is, the NPC should also be able to find and traverse paths, chase the player, patrol, hide, etc. However, visual features such as gunfire, explosions etc. are not required.

## Part A:

The proposed game will occur in an indoor prototype labyrinth with the following features:

1. **Player:** The game will accept a single user’s avatar as the “player”. The player will use A\* path finding to navigate through the waypoint graph.
2. **NPC:** You will create four (4) NPCs (they can be primitives; e.g. boxes) that will occupy the indoor labyrinth space. The NPC will employ both A\* and Greedy search algorithms. Specifically:
   1. **The NPCs Patrol/Roam behaviour will use Greedy**
   2. **The NPCs Attack and Hide behaviour will use A\***
   3. **Any other optional behaviours can employ either pathfinding algorithm**

Your NPC will be reactive agents based on Discrete Finite Automata (DFA) with Moore machine policies, so that each DFA has at least three states. You will implement these DFA according to your own design and with respect to your trigger layout. This will be explored during related workshops.

*For the artistic: You are free to apply any built-in animated characters (however, don’t spend too much time on such features).*

1. **Triggers and Place Markers:** In this assignment, triggers need not be confined to objects with the trigger property set, but can be any kind of trigger mentioned in the lectures. You will layout triggers to suit your own design and your design of NPC and their reactive policies. You should define each Place Marker as a transparent Phantom object.
2. **Navigation Structures:** The NPC that executes your path-finding code should use the provided waypoint graph. Creating your own waypoint or grid/tile based system is allowed, but not recommended if you are not a strong programmer. Implementing your own navigation structure will subject your assignment to additional marks ☺
3. **Path Finding Algorithms:** Both the Greedy search or the A\* algorithm should be applied for path finding and should be applied to the appropriate path finding problems. This will be explored in detail and implemented during workshops related to path finding.
4. **Heads up:** I will not be accepting late assignment excuses due to the QUT assignment policies. If you apply good software practices then you should always have a backup. The, “everything lost” excuse won’t work, especially as we will be incrementing our design over several weeks. Back up your assignment!

## Part B:

The format for this part is as follows:

1. **Title page**: Including your name, student number and unit code (some students are postgraduates)
2. **Statement of Completeness**: What was/was not completed in the assignment.
3. **Path Finding**: A section where you discuss path finding using the Greedy and A\* search algorithms.
4. **Finite State Machines**: A section where you discuss the FSA that you used in creating your NPC policies.
   1. A state diagram for each DFA.
   2. Trigger and place marker layout diagrams concerning each NPC.
5. **Conclusion**: A summary of what you have learned.

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| **Part A of IGB383 Assignment 1: MARKING CRITERIA**  The assignment is designed to assess certain aspects of the objectives for this subject  Performance standards and criteria for each objective appear below | | | | | | |
| **Criteria** | **Performance Standards** | | | | | |
|  | **High Distinction** | **Distinction** | **Credit** | **Pass** | **Fail** | **Mark** |
| **NPC Policies**  relates to:  Outcomes 3 & 4 in the unit outline | There were 4 NPC. Each NPC had a unique Discrete Finite Automata (DFA) policy. No DFA had less than three states. | There were 4 NPC. Each NPC had a Discrete Finite Automata (DFA) policy. No DFA had less than three states. | One major instance that did not adhere to the following:  There were 4 NPC. Each NPC had a unique Discrete Finite Automata (DFA) policy. No DFA had less than three states. | Up to 4 major instance that did not adhere to the following:  There were 4 NPC. Each NPC had a unique Discrete Finite Automata (DFA) policy. No DFA had less than three states. | More than 4 major instance that did not adhere to the following:  There were 4 NPC. Each NPC had a unique Discrete Finite Automata (DFA) policy. No DFA had less than three states. |  |
| 7 – 6.5 marks | 6 – 5.5 marks | 5 - 3.5 marks | 3 – 2 marks | 1.5 – 0 marks |  |

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| **Criteria** | **Performance Standards** | | | | | |
|  | **High Distinction** | **Distinction** | **Credit** | **Pass** | **Fail** | **Mark** |
| **Path Finding Algorithms**  relates to:  Outcomes 3 and 4 in the unit outline | Correctly implemented either the Greedy search or the A\* search algorithms for path finding. Successfully Applied path finding algorithms to the appropriate search spaces. NPC always complete their path traversals. | Correctly implemented either the Greedy search or the A\* search algorithms for path finding. Applied path finding algorithms to the appropriate search spaces. NPC complete their path traversals, but there may be some non-trivial reasons for traversal failures. | Correctly implemented either the Greedy search or the A\* search algorithms for path finding. Applied path finding algorithms to the appropriate search spaces. There are many obvious reasons that traversals may fail. | Implemented either the Greedy search or the A\* search algorithms for path finding. Applied path finding algorithms. There are many obvious reasons that traversals may fail. | Failed to implemented either the Greedy search or the A\* search algorithms for path finding. Applied path finding algorithms. There are far too many obvious reasons that traversals may fail. |  |
| 10 – 9 marks | 8 marks | 7 marks | 6 – 4 marks | 3 – 0 marks |

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| **Part B of IGB383 Assignment 1: MARKING CRITERIA**  The assignment is designed to assess certain aspects of the objectives for this subject  Performance standards and criteria for each objective appear below | | | | | | |
| **Criteria** | **Performance Standards** | | | | | |
|  | **High Distinction** | **Distinction** | **Credit** | **Pass** | **Fail** | **Marks** |
| **Communication (Theory)**  relates to:  Outcomes 1, 2 & 3 in the unit outline | Completely accurate statements describing path finding with Greedy search. Completely correct statements describing path finding with A\* search. Made precise statements using terminologies from the lectures. Gave correct state machine diagrams in terms of states and notations. | Correct statements describing path finding with Greedy search. Correct statements describing path finding with A\* search. Made precise statements using terminologies from the lectures. Gave sufficient state machine diagrams in terms of states and notations. | Correct statements describing path finding with Greedy search. Correct statements describing path finding with A\* search. Made reasonable use of terminologies from the lectures. Gave generally defined state machine diagrams in terms of states and notations. | Statements that generally describe path finding with Greedy search. Statements that generally describe path finding with A\* search. Made moderate use of terminologies from the lectures. Gave loosely defined state machine diagrams in terms of states and notations. | Statements that fail to describe path finding with Greedy search. Statements that fail to describe path finding with A\* search. Made little use of terminologies from the lectures. Gave no or poorly defined state machine diagrams in terms of states and notations. |  |
| 5 – 4.5 marks | 4 marks | 3.5 marks | 3 – 2 marks | 1.5 – 0 marks |  |

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| **Part B of IGB383 Assignment 1: MARKING CRITERIA**  The assignment is designed to assess certain aspects of the objectives for this subject  Performance standards and criteria for each objective appear below | | | | | | | |
| **Criteria** | **Performance Standards** | | | | | | |
|  | **High Distinction** | **Distinction** | **Credit** | **Pass** | | **Fail** | **Marks** |
| **Software**  relates to:  Outcomes 3 & 4 in the unit outline | All scripts compile. Clean programming style. Correct & efficient code. No logical errors. All necessary variables in the script files have been set. | All scripts compile. Good programming style. Correct code. No logical errors. All necessary variables in the script files have been set. | All scripts compile. Reasonable programming style. Correct code. Non-invasive logical errors. All necessary variables in the script files have been set. | 80% of scripts compile. Minor programming style issues. Correct code. Some minor logical errors. Most variables in the script files have been set. | | Less than 50% of scripts compile. Major programming style issues. Incorrect code. Major logical errors. Failed to set most of the necessary variables in the script files. |  |
| 8 – 7 marks | 6.5 – 5.5 marks | 5 – 3.5 marks | 3 – 2 marks | | 1.5 – 0 marks |  |
| **Comments:** | | | | | Total Mark Awarded | |  |