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| **Qualification details** | | | |
| **Training Package Code and Title:** | **ICT - Information and Communications Technology (Release 7.0)** | | |
| **Qualification National Code and Title:** | ICT40120 Certificate IV in Information Technology (Gaming Development) | **State code:** | BFF9 |

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| **Assessment Title** | **AT01 Indie Game** | | |
| **Unit National Code & Title** | ICTGAM423 Apply artificial intelligence in game development (Release 1) | | |
| ICTGAM430 Design interactive media (Release 1) | | |
| **Date Due** | ***25/03/2024*** | **Date Received** | ***12/02/2024*** |

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| **Student Name** |  | **Student ID** |  |
| **Student Declaration** | I declare that the evidence submitted is my own work:  ………………………………………….. | | |

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| **Assessor Name** |  | | | |
| **Assessment Decision** | Satisfactory | | Not Yet Satisfactory | |
| **Assessor Signature** |  | | **Date** |  |
| **Is student eligible for reassessment (Re-sit)?** | No | Yes | **Reassessment Date:** |  |

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| **Feedback to student** | | | |
| *Via Blackboard (LMS) – Please check [Grade] section.* | | | |
| **Feedback from student** | | | |
| *Via Blackboard (LMS) – Please use [Comment] section during submission.* | | | |
| **Student signature** |  | **Date** |  |

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| **Assessment Instructions** |

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| **TO THE ASSESSOR** | |
| Type of Assessment | *Project* |
| Duration of Assessment | *7 Class Sessions (Session 3 - 9)* |
| Location of Assessment | *Classroom, at home* |
| Conditions | *Skills in this unit must be demonstrated in a workplace or simulated environment where the conditions are typical of those in a working environment in this industry.*  *This includes access to:*   * *the internet* * *research tools* * *required hardware, software and its component* * *path-finding libraries* * *game development testing tools* * *development tools to implement AI strategies* * *game design specifications and documentation* * *required hardware and software and peripheral devices* * *human-computer hardware interface devices* * *a range of event-handling systems* * *application libraries* * *widgets* * *graphical user interface software and libraries* * *games engine* * *a range of browsers and digital devices* * *client requirements documentation* * *file storage*   *Learners are required to complete the required tasks and submit the required evidence electronically via Blackboard.* |
| Elements and Criteria | As detailed in the assessment plan  You are required to make sure that all students meet the elements, performance criteria and oral communication items as outlined in the provided checklist. |

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| **TO THE STUDENT** | |
| Purpose of Assessment | You are required to show you can:  *ICTGAM423 - Apply artificial intelligence in game development*   * Conduct research on AI strategies * Design, implement and test AI game strategy * Evaluate game and confirm with required personnel   *ICTGAM430 - Design interactive media*   * Identify and research human-computer hardware interface devices, event-handling systems and graphical user interface (GUI) widget sets * Design a simple media software device * Build and implement a simple media software device   You are required to meet the elements, performance criteria and foundation skill items as outlined. |
| Allowable Materials | Blackboard (Topic by topic) will include the following: Weekly Readings, Class notes, and Weekly Activities.  Internet resources must be recorded as references for the assessment. |
| Required Resources | *Computer with:*   * *Internet Access* * *Word processing software* * *Access to Learning Management System (LMS)* * *Unity (college version)*   *Version control software (GitHub, SourceTree)* |
| Reasonable Adjustment | In some circumstances, adjustments to assessments may be made for you. If you require support for literacy and numeracy issues; support for hearing, sight or mobility issues; change to assessment times/venues; use of special or adaptive technology; considerations relating to age, gender and cultural beliefs; format of assessment materials; or presence of a scribe you need to inform your lecturer. |
| Assessment Submission | *All activities must be attempted.*  *Use of research tools and peers in formulating answers are acceptable – but work submitted must be your own work and must not be plagiarised.*  *Final files and documentation are to be uploaded to the appropriate area in the Blackboard course created for this unit.*  *If you are marked as NYS (Not Yet Satisfactory) on your first attempt, you will be provided with another opportunity to re-attempt the assessment.* |
| Project contents | This project consists of the following tasks:   * *Interpret the requirements of a provide Game Design Brief* * *Plan and produce the following according to the requirements listed in the Game Design Brief:*   + *an AI NPC with path-finding between patrol points*   + *a custom UI widget*   + *human-computer interface devices* * *Produce a prototype or ‘beta’ of a game project meeting the requirements listed in the Game Design Brief* * *Perform testing of the prototype and plan amendments based on test results* * *Produce a gold-master build of the game with all required elements* |

# Documentation Guidelines/Requirements

This assessment requires you to work through the production pipeline for a simple indie game developed in the Unity game engine.

The competencies being assessed include the ability to:

* Research & document information about game development and the industry
* Gather and brainstorm ideas for your project
* Evaluate different techniques and approaches
* Plan the production of the game using practices which are standard to the industry & suitable for working in a larger production team
* Test ideas and concepts decided on during planning, evaluate the outcome and make changes as necessary
* Reflect on your own performance and identify areas for improvement

In order to provide evidence that you have met these competencies you will be required to create and maintain documentation which provides a record of your work on the project.

You may do this either by using this assessment cover sheet in the spaces provided under each task. Alternatively you may create a separate document (a *Production Diary)* formatted in a way which makes sense for you as well as providing the required evidence.

Either way, your documentation will need to provide evidence of how you addressed or completed each of the tasks in this coversheet. For many tasks this will essentially consist of short written answers (approximately one to two paragraphs/100-200 words). Other tasks will require diagrams, sketches and/or screenshots of work performed in other applications.

An exemplar *Production Diary* document for a different project will be provided in the Blackboard shell and discussed in class.

# Assessment Summary & Game Requirements

You are to produce a simple indie game in the Unity game engine to add to your online portfolio demonstrating the implementation of fundamental game mechanics.

To avoid falling into the trap of over-scoping your game you are to work within the creative restraints provided in the document *Indie Game Brief*.

In short the requirements are:

* **Produce a first-person perspective game for Windows and browser platforms.**
* **The game must be playable with either keyboard and mouse or the gamepad of your choice**
* **The game revolves around the player exploring a 3D environment, searching for a key item which will unlock an exit to allow them to leave the game**
* **While the player searches they must avoid being detected by an AI NPC which patrols the environment**
* **The AI NPC will chase the player if they spot them, and the player receives a GAME OVER if they are caught**
* **The player can defend themselves in a limited fashion using a stun which has a cooldown**

# Technical Requirements

Refer to the *Indie Game Brief* document for the full, comprehensive list of technical and design requirements.

This is a summary of those requirements:

* You will need to use version 2022.3.14.f1 of the Unity game engine for this project.
* The 3D model for the AI NPC will need to be rigged and given appropriate animations.
* The AI NPC needs to use either Dijkstra or A\* pathfinding algorithm for its primary navigation.
  + You may use the Unity engine’s built-in Navmesh and accompanying tools to achieve this.
  + You may also choose to create your own navigation mesh, and create the Dijkstra/A\* pathfinding algorithm from scratch – this is not a requirement, but can be very good practice if you want a challenge.
* For the AI’s *patrol* and *search* behaviour a simple graph of waypoints should be implemented, and a simple pathfinding algorithm implemented to allow the AI NPC to construct and follow the waypoints when it is not directly chasing the player.
  + The *Breadth-First Search* algorithm is recommended, but you may choose to implement other pathfinding algorithms
* Appropriate sound effects must be included to match the gameplay as detailed in the *Indie Game Brief* document.
* All 3D models must be textured and animated appropriately. No placeholder assets should be present in the final submission.
* 3rd party assets (such as from the Unity Asset Store) may be used, but must be credited both in your documentation and in a credits page in the game’s main menu.
* All code must be appropriately commented to demonstrate your understanding of its implementation. The use of external resources (tutorials and AI tools) is acceptable but must be documented. Any code taken from an external source (tutorials and/or AI tools) again must be commented to both show that the code was sourced from someone else, and that you understand how it works but received assistance in implementing it.
* The game must be playable both on Windows 10/11 PCs (as a .exe file) and on web browsers through the *itch.io* site.
* The game must be playable with both keyboard + mouse inputs and a gamepad controller

# Section 1 – Research and Analysis

## Task 1 - AI Pathfinding Strategies

* Research and provide an explanation of how pathfinding is used in video games.  
    
  Conduct a case-study of the 'evolution' of path-finding in video games by analysing the pathfinding used in:
  + The original *DOOM*
  + *StarCraft:* *Brood War*
  + *StarCraft II*

In your answer provide:

* + A summary of how each game's AI NPCs would seek out a path in the game environment.
  + Key differences in the performance of the pathfinding and behaviour of AI NPCs in each game
  + An analysis of how the design of a video game may be influenced by the use of different pathfinding techniques based on the results of your research.
  + A definition for the terms *flocking*, *avoidance, cohesion,* and *orientation* in pathfinding

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| Explanation **of Pathfinding in Video Games:**  Pathfinding in video games involves determining the best route for NPCs (non-Player Characters) or units to reach a specific destination while navigating obstacles and terrain. This is crucial for creating believable AI behaviour and enhancing player experience.   * **Original DOOM:** * In the original DOOM, NPCs used a simplistic pathfinding algorithm that involved basic line-of-sight checks and grid-based movement. They followed predefined routes or directly moved towards the player, often exhibiting predictable behaviour. * **StarCraft: Brood War:** * Pathfinding in StarCraft: Brood War improved with the use of more sophisticated algorithms, such as A\* (A-star). Units calculated paths based on terrain, avoiding obstacles, and dynamically adapting to changes in the environment. * **StarCraft II:** * Building upon its predecessor, StarCraft II featured further advancements in pathfinding. Units displayed improved navigation around obstacles, better collision avoidance, and more realistic movement, enhancing the overall gameplay experience.   **Key Differences and Analysis:**   * Performance: Each game showed advancements in pathfinding efficiency and accuracy, with later titles offering smoother NPC movement and better adaptation to complex environments. * Behaviour: As pathfinding improved, AI NPCs exhibited more natural and varied behaviour, enhancing immersion and strategic depth for players. * Design Influence: The choice of pathfinding techniques directly influenced gameplay mechanics and level design. Games with more advanced pathfinding could feature complex maps with intricate terrain and dynamic obstacles, challenging players to adapt their strategies.   **Definition of Terms:**   * Flocking: Refers to the behaviour of entities (e.g., NPCs or units) moving in a group, where they align, avoid collisions, and move towards a common direction. * Avoidance: Involves NPCs or units dynamically changing their paths to avoid collisions with obstacles or other entities. * Cohesion: Describes the tendency of entities to stick together as a group, maintaining proximity to one another while navigating. * Orientation: Refers to the direction an entity is facing or moving towards while navigating the game environment. |

* Based on the research on pathfinding strategies and your understanding of the requirements for the AI's navigation in the *Indie Game Brief*, write a brief summary of how you intend to handle the pathfinding logic in this project.

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## Task 2 - Human Computer Interaction (HCI)

* Research and select HCI devices which will be compatible with your game project.  
    
  Identify and describe two (2) standard HCI devices which can be used in this game project according to the design brief.  
    
  Conduct research and identigy three games of your choice from different genres which provides the same HCI device options as what you are planning to use.   
    
  For each game you have identified:
  + Identify the genre of the game
  + Explain the control scheme in the game for each of your chosen HCI devices
  + Reflect on the design choices which may have impacted the implementation of the HCI devices, including elements such as what is 'typical' or 'standard' for the chosen genre.

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* Conduct research on event-system implementation in the Unity game engine. Describe how you can use the event-system to implement the required HCI device functionality.  
    
  Your explanation should identify how event handling system can be used to provide feedback to the user on the input from the HCI devices by updating the relevant UI widget

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## Task 3 - Graphical User Interface (GUI)

* Identify and describe how at least two (2) compatible GUI libraries may be used in Unity to implement the required UI widgets in this game.  
    
  Provide a summary of each GUI library and explain which of them will be most suitable for this game project.   
    
  Your explanation should identify how the *stun cooldown indicator* and the *current objective* indicator will be implemented.

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* Identify two (2) examples of UI widgets from the HUDs of existing video games which perform similar functionality to the two widgets you are required to design.  
    
  Describe the functionality of each example and explain how each example has been used within the HUD of the video game they are in.

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## Task 4 - Research and Planning Meeting

Once you have complete task 1 through to 3 in Section 1 you will need to organize a meeting with your lecturer to present your research and discuss the implications it has on your ideas for the game project.

In this meeting:

* Discuss how the results of your research into pathfinding in video games has influenced your ideas for the implementation of the AI in this game. Present your initial plan for the implementation of the AI.
* Discuss your findings in your research into HCI devices and the Unity event systems. Explain to your lecturer how you intend to implement the required HCI devices for this game and how events can be used to integrate them with the same C# method.
* Discuss your plans for the implementation of the UI widgets for this project based on the research you have done.
* Record any feedback or required changes given to you by your lecturer. Apply the changes as required before moving to the next step of planning.

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| *(Record feedback and suggested changes here)* |

# Section 2 - Pre-Production & Planning

## Task 1 - Design Feasible AI strategy

To design an AI NPC that fulfills the required design for this project you will need to plan out a range of goals, actions and other factors. These will guide the behaviour of the AI and it's decision making.

* Create a behaviour chart that outlines the functionality of the AI.  
    
  The chart should define the states, state transitions and the conditions of the state transitions.   
    
  Provide a summary of the AI behaviour and explain how your proposed implementation meets the specifications outlined in the *Indie Game Brief*.

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* Provide creative design solutions to the following potential design issues:
  + the ability for the AI to handle doors which can be opened and closed
  + the AI 'hunting' for the player in a way which simulates that they are 'aware' of the player's presence, but not their exact location
  + a way for the playing area to potentially 'expand' as the project scales up

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* Reflect on the proposed design of the NPC and assess how technically feasible and user-friendly the design is. Provide an estimation of the timeline and budget for the production of the NPC and consider how this would impact the rest of the project.  
    
  Use the three-point estimate (beta distribution) formula to calculate your estimation for the time and budget costs for implementing the AI NPC. Use a wage of $32.90 AUD per hour in the calculation.  
    
  In your reflection consider your own assessment of your skill levels and knowledge, as the person who will be implementing this design, versus the timeframe for this project.

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## Task 2 - Plan out Implementation of 3D Model & Animations

This project requires you to utilize animations on the AI NPC for each of the states that it can enter.

The model for the AI NPC may be sourced from places such as the Unity asset store, as well as the required animations. Where you have used assets sourced from 3rd parties you must indicate this in your documentation and in the credits page of the game's main menu.

You are also required to provide animations using Unity's tools for:

* **Doors which can open and close**
* **An idle/floating animation for the key item**
* **An animation sequence for the camera to complete when the player receives a 'GAME OVER'**
* Plan out the AI NPC's animations to match the different behaviour states that the AI NPC will need to switch between.

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* Plan out pseudo-code and/or a flowchart demonstrating how you can implement doors which will open and close using Unity's animation tools

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* Plan out pseudo-code and/or a flowchart demonstrating how you can implement the animations for the key item as specified in the *Indie Game Brief*

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* Plan out pseudo-code and/or a flowchart demonstrating how you can implement the camera animation sequence which should play when the player receives a 'GAME OVER'

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## Task 3 - Design custom GUI widget

To ensure that the GUI widgets you create for your game will fulfil the intended role in the game's design you will need to create a prototype which clearly communicates the functionality.

* Create a *paper prototype* of the UI widgets which are required according to the *Indie Game Brief*.   
    
  This paper prototype should take the form of original illustrations, diagrams and/or sketches. Note that it does not need to literally be drawn on paper - a digital mock up in an application such as *Photoshop* is fine!  
    
  The paper prototype should include relevant annotations which communicate the full functionality of the UI widget, demonstrating and explaining what information the widget will convey and how it will link back to the relevant C# event-handling methods.

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## Task 4 - Planning & Pre-Production Meeting

Consult with the lecturer to confirm that the AI strategy, 3D models, animations and GUI widgets conform to the requirements of the *Indie Game Brief*.

Organize a meeting to discuss:

* Your plans for the implementation of the AI strategy and how you intend to overcome the potential design issues identified in Task 1

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* The 3D model/s you intend to use for the AI NPC, and the animations you plan on implementing for it.   
    
  Additionally, show your planning documentation for the door, key item and death camera animations.

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* The design and implementation of the GUI widgets to be displayed in the HUD. Explain to the lecturer how event systems will be used to update the information displayed on the widgets and provide feedback to the player on their inputs during gameplay.

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# Section 3 - Prototype

With the research and planning complete you are now ready to begin creating the game.

You will be required to maintain a work log demonstrating how you completed each step of the development. This will serve as evidence of your ability to perform each of the required elements which indicate competency in this assessment.

While the specific order in which you tackle this project is mostly dependent on your own preferences, you will need to provide evidence of the parts of the process detailed in the tasks below.

Provide a visual record of your development process in Unity, Visual Studio and any other software used by taking regular screenshots to demonstrate progress.

*Tip: use screen recording software such as OBS, Nvidia Shadowplay or even Microsoft Office Powerpoint to record while you work. Take screenshots from the video later to provide the visual evidence.*

## Task 1 – Implement Player Movement and Interaction

You will need to provide evidence of how you integrated the two required HCI devices.

* Create the relevant scripts which will allow the player to navigate the game environment as per the requirements of the game brief.

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* Create the relevant scripts which will allow the player to interact with the game environment as per the requirements of the game brief.

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## Task 2 - Implement AI Strategy

Provide evidence of how you implemented the planned AI decision making and path-finding strategy.

* Create the required scripts and game objects which will allow the AI to navigate the environment using the Unity NavMesh and the path-finding algorithm you created for forming paths between waypoints.

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* Create the required scripts and game objects which control the AI NPC's decision making

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## Task 3 – Implement Animations

Provide evidence of:

* Your process for implementing the required animations on the AI NPC character

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* Your process for implementing the required animations for
  + The interactable doors
  + The key items
  + The 'death camera' cinematic

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## Task 4 - Implement GUI menus and UI widgets

Provide evidence of:

* Your process for implementing the required UI widget elements in the HUD of the game.  
    
  Demonstrate how your custom UI widget showcases captured events from the two integrated HCI devices

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* Your process for implementing the required GUI menus
  + Main menu
  + Pause menu

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# Section 4 - Testing & Gold Master

## Task 1 - Functionality Testing & Bug-Checking

Now that your prototype is in a playable state you will need to perform functionality testing and check for any bugs.

* Create a test table designed to check the required functionality of the game is working. Your test table should also include as many scenarios as feasible to try and capture any possible issues or bugs.  
    
  Remember that when creating your test cases you cannot assume anything is working or bug-free unless you have actually tested it.   
    
  *EG: I have created a simple calculator app. I 'know' that hitting the left and right arrow keys alternating does not do anything, since I did not program this functionality. But until I actually test this and confirm it, I don't actually 'know'.*

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* Resolve any issues discovered during the functionality and bug testing process.  
    
  Record the process of fixing these errors and repeat the tests to confirm that the issues are resolved. Update the testing table to show that the follow-up tests were performed.

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* Perform a final check to confirm that the functionality of the game conforms to the design specified in the game brief.

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## Task 2 - Gold Master

Once you are certain that all the required elements have been incorporated into the game project and that all functionality has been tested, you are ready to export the final product and submit the assessment.

* Create a web-build of the Gold Master and upload it to *itch.io*. Include the link to the project here.

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| *Link to project:* |

* Create a desktop build of the Gold Master and place it into a .zip folder
* Export the project files from the Unity editor as a *.unitypackage* file and place them into a .zip folder
* Submit the following to Blackboard in a .zip folder:
  + The .zip file contaning desktop build of the Gold Master
  + The .zip file containing the *unitypackage* file of the project
  + A completed and signed copy of the observation checklist indicating that all meeting have been completed with your lecturer
  + A copy of this assessment cover sheet
  + (if applicable) a copy of your production diary/documentation demonstrating the evidence gathered during your development process
  + Any other documentation or evidence you feel demonstrates your completion of this project