# Personal Logbook

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| Degree Course | Computer Science BSc |

## Work over the summer -

**Planning:**

During the summer I spent the vast majority of the time I allocated to preparation work deciding on exactly how the game will work. I made a feature list and made spent some time to make sure that they were feasible in the time frame.

The rest of the time was spent deciding on how I would go about creating the game, specifically which game engine I would use.

**Action:**

I tried out a both the Unreal Engine and the Unity engine, but in the end decided that I would create the game in C++ using the SDL2 library as it would allow me to have full control over all of the games features.

**Reflection:**

Overall the amount of work I did over the summer ended up being less than I had hoped to do and I never managed to get around to doing any sort of research into the specific mechanics of the game.

## October 2015

### Wednesday the 7th

**Action:**

I had my first meeting with my supervisor at 11am we discussed what I had planned for the game and he gave suggestions as to what I should aim for with the game. He suggested a few materials that I could read and use as a starting point for my research.

**Planning:**

The next nine days will be dedicated to reading materials that are relevant to the game and writing the initial report. I plan to spend the next day reading through the resources that Diego suggested and then after that moving onto writing the report and finding further papers to read.

**Action:**

Read the relevant parts of the book suggested by Diego “AI Game Programming Wisdom” and wrote up all of the points from the book that may be relevant to my game.

Book above - Steve Rabin, AI Game Programming Wisdom, Charles River Media, 2002

### Thursday the 8th

**Action:**

Started to create the initial report document, I wrote in the material from the most relevant parts of the book, AI Game Programming Wisdom, into the background reading section.

I read also read a large part of the book “The Theory of Fun for Game Design” as suggested by Diego, however I didn’t find any material that I thought was particularly relevant to the project.

### Friday the 9th

**Action:**

Spent the day reading a book on genetic programming techniques “A Field Guide to Genetic Programming” and a paper on procedural content generation “Towards Automatic Personalized Content Generation for Platform Games”. I couldn’t find anything in either that I deemed relevant enough to add to the document, I wrote up the most relevant parts in my resources document just in case its useful in the future.

Poli, R., Langdon, W.W.B., McPhee, N.F., Koza, J.R.: A field guide to genetic programming. Lulu. com (2008)

Shaker, N., Togelius, J., Yannakakis, G.N.: Towards automatic personalized content generation for platform games. In: Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE) (2010)

### Saturday the 10th

**Action:**

Started writing the project goals section of the initial report, I re-wrote the feature list I had created over the summer in a more pleasing manner and made this into the project goals section.

I spent the rest of the days working time reading and making notes from the paper “The definition and rendering of terrain maps”.

G. S. P. Miller, “The definition and rendering of terrain maps,” in Proceedings of SIGGRAPH, vol. 20, 1986.

### Sunday the 11th

**Action:**

I spent the first part of today’s working time writing up the notes taken from the paper “The definition and rendering of terrain maps” yesterday and adding it to the background reading section, as there was a good amount of useful content in the paper.

The first paper I read today was “Controllable procedural map generation via multiobjective evolution”, I spent a lot of time reading this paper and there is a large amount of potentially relevant content. I have written the most relevant parts into my resources document and will add it to the initial report later if I feel that it is needed.

I then spent the rest of the time reading the paper “Controllable procedural terrain generation using software agents” this paper was very interesting, but took a long time to read as some of the concepts were quite hard to grasp so took longer than some of the other materials to write up

Togelius, J., Preuss, M., Beume, N., Wessing, S., Hagelback, J., Yannakakis, G.N., Grappiolo, ¨ C.: Controllable procedural map generation via multiobjective evolution. Genetic Programming and Evolvable Machines pp. 1–33 (2013)

J. Doran and I. Parberry, “Controllable procedural terrain generation using software agents,” IEEE Transactions on Computational Intelligence and AI in Games, 2010.

### Monday the 12th

**Action:**

I couldn’t find much time to work today so decided to write up my notes from yesterday and add them to the background reading section of the initial report.

### Tuesday the 13th

**Action:**

I had my second meeting with my supervisor today; we discussed the progress I had made with the initial report. We also discussed in length my feature list for the game and he made a number of suggestions with what I could add to it and what I could revise to make the project a higher technical difficulty.

After the meeting I finished updated the project goals section of the report with what was discussed in the meeting. I then went onto read the book “The algorithmic beauty of plants” and I made sure to add to my background reading section the parts from this book about grammatical generation of content.

Prusinkiewicz, P., Lindenmayer, A., Hanan, J.S., Fracchia, F.D., Fowler, D.R., de Boer, M.J., Mercer, L.: The algorithmic beauty of plants, vol. 2. Springer-Verlag New York (1990)

### Wednesday the 14th

**Action:**

As the deadline is approaching I decided to finish the background reading section of the report today, this included adding any leftover notes I had and making sure that the referencing was to the expected standard.

I then went on to complete the project goals section with any additional details that I hadn’t added before.

**Planning:**

I did not get time today, but I must remember to write up the project plan. The methodology will be agile.

### Thursday the 15th

**Action:**

The first task of the day was to create the project plan section of the report. This almost exclusively consisted of a sprint plan for the entire project.

I then went back and re-read the whole document and made a few changes to it, mostly styling changes.

### Friday the 16th

**Action:**

Before the final deadline of the initial report I re-read the whole document to make sure that it was completed. I found no changes that could be completed within the time frame to be made, so left the version that was already submitted as the final version.

### Monday the 19th

**Reflection:**

After completing the initial report I certainly feel a little more confident that this project will go well. Although having said that I am not too happy with how the initial report went, I feel like I should have added more to the background reading section and that I should have referenced some of the articles I read that I didn’t reference even if it was a small part that was relevant to the game.

I have also already decided that I need to change my project plan, I will instead of working on landscape generation, work on character generation as this will be a quicker process and is just as important. It will also give me some practice in procedural content generation before I undertake the larger task of creating a whole world map.

**Planning:**

The next week will be spent creating the translating the project goals into requirements for the final game. Once this has been completed I will move onto designing characters for the game as this will be the first thing I implement into the game.

**Action:**

Copied the project goals into a bullet point format and refined them into the requirements for the game.

### Wednesday the 21st

**Action:**

Refined the requirements some more and finished them off.

I then moved onto creating designs for the characters body parts and items of clothing, all of the designs are just outlines and important features such as eyes, as the rest of the textures will be filled in procedurally.

### Thursday the 22nd

**Action:**

Created a few more designs for characters and clothing, I also made a sword item when I got side tract. While this was not originally planned I will keep it and use it later when I create the items for the characters.

### Friday the 23rd

**Action:**

Finished creating designs for the characters, I now have a different variation of each character for each of the character types, as well as at 3 pieces of clothing for each. This should allow for a large number of different variations of appearance.

### Thursday the 29th

**Reflection:**

Over the last two weeks I created the designs for the characters and their clothing. I managed to complete what I had planned to do within the time set out, however due to other commitments I was unable to move onto the next stage for the last few days. I will try to catch up with the creation the characters game code over the weekend.

### Friday the 30th

**Planning:**

The next step in the development is to start creating some code. I will spend the weekend setting up the SDL2 development library on my computer and will start implementing the NPC and player character display.

Once the display is working I will then move onto making the character generation, that is to say making each character look unique based on pre-requisites and randomness.

### Saturday the 31st

**Action:**

I started installing the SDL2 library on my windows 10 partition in the morning but after about 4 hours of nothing but errors I decided to install it on my Ubuntu partition instead and got it installed in about half an hour.

## November

### Sunday the 1st of November

**Action:**

After the problems of installing yesterday I started to write some very basic code to display an image and discovered that there was a problem with my CMake file and that it wasn’t able to locate the SDL2 header files. After a few hours I managed to get this issue fixed but ended up not having enough time to get any further with regards to the game.

### Monday the 2nd of November

**Reflection:**

The weekends work was far less productive than I had imagined it would be. But unforeseen errors are something that I need to work around. I will try to get a lot more done in the coming days to make up for the lack of work over productive work over the weekend.

### Tuesday the 3rd of November

**Action:**

Had a meeting with my supervisor at 10am today. We discussed my current plan, and it was suggested that I try to get a basic shell for the game going rather than focussing on a single part of the game. This will let me find potential problems that I wouldn't otherwise anticipate meaning that I can change my method of creation if the issues require it.

### Wednesday the 4th of November

**Planning:**

As stated in the previous entry, it was suggested that I try to get a basic game logic running so that After the meeting with my supervisor I have decided to create the basic game loop that will run the game, and create basic character that can be moved around a blank map using a users inputs.

### Thursday the 5th of November

**Action:**

The game loop has been created, it consists of a process to deallocate the memory used by textures that are no longer in use, a process to load new textures and a process to update the positions of textures.

### Friday the 6th of November

**Action:**

The basic model of a character has been added to the loaded textures in the game loop, the user can then use the WASD keys to move this character around the screen. There is currently no animation for the movement of the character and the character moves around the screen rather than the character being central to the screen and the background moving around the character, which is what the movement will look like when it is finished. However as no textures for the terrain have been created as of yet keeping the character at the centre of the screen would not allow for testing the movement as on a blank background it would be hard impossible to tell if the input was working correctly.

### Monday the 9th of November

**Reflection:**

As I have finished creating the basic game loop and character movement input I feel that I can say that this weeks goal was met fully. Although I feel that I should have set out to complete more than I had originally planned on doing as I ended up completing the work more quickly than expected. I will amend this in the future so that I can more accurately predict how much work I can complete in a certain time frame.

### Tuesday the 10th of November

**Action:**

Meeting with supervisor at 10am. During the meeting we discussed the progress that was made over the last week and discussed where to go from there. It was decided that the next step would be to create the terrain of the game so that designing the procedural generation algorithms could be started soon.

### Wednesday the 11th of November

**Planning:**

The plan for this week is to create the terrain tiles that will be used in the game. These tiles will be used by the terrain generation algorithm when they are completed.

The tiles will be 16x16 pixels in size and there will be a number different types, the main ones will be:

Grass, Dirt, Stone, Sand and Pavement. Each of the types will have variations to show different types of terrain, for example grass will have a lush, dry and dead texture so that the player knows the terrain is changing.

### Thursday the 12th of November

**Action:**

Created the Grass terrain type tiles. Six tiles were created in total these were as follows: a dead grass texture, a dying grass texture, a dry grass texture, and two variations on lush grass, one with deeper greens and one with lighter greens.

### Friday the 13th of November

**Action:**

Created the Dirt terrain type tiles. Three were created in total, the base dirt type, a dirt with gravel type and a gravel type.

### Saturday the 14th of November

**Action:**

Created the Water type tiles. Three were created, one for a small stream, one for a river and one for the sea.

### Sunday the 15th of November

**Action:**

Created the Pavement type tile. A single cobblestone type pavement was created. I chose to make only a single type of pavement as the game is set in a fantasy medieval era so there wouldn't have been any extravagant types of pavement available. This may change in the future.

### Wednesday the 19th of November

**Reflection:**

Since the last meeting I have spent the week creating the texture tiles for the terrain. This has not been completed yet and as such has not been implemented into the program as of yet. This is the next stage after all of the tiles have been created. Once the tiles are implemented as the terrain I will be able to start creating the procedural generation of terrains.

### Thursday the 20th of November

**Planning:**

Due to having a large number of assignment deadlines to complete in the next two weeks I plan to finish continue creating the terrain tiles when I can find spare time. I don't expect to be able to complete them before the end of next week.

### Monday the 23rd of November

**Reflection:**

Since the last entry I haven't managed to finish off creating the terrain due to other tasks that needed taking care of. This looks set to continue as I still have two deadlines to complete work for within the next week. I should be able to find time to complete the terrain tiles over the weekend.

### Friday the 27th of November

**Action:**

Created the Sand type tiles. Two tiles were created, one for a lighter type of sand that will be used for beaches and one a slightly darker type that will be used for desert type terrains.

### Saturday the 28th of November

**Action:**

Created the Sandstone type tiles. Four tiles were completed, the four tiles vary by going from a darker red sandstone to a lighter more orange tone.

### Sunday the 29th of November

**Action:**

Created the Gray Stone type tiles. Five tiles were created these were varying in different shades of grey, going from lighter shades to much darker shades. These will be used to show different types of grey rock.

### Monday the 30th of November

**Reflection:**

Over the weekend I was able to finish creating all of the terrain tiles for the different types of terrain, as well as variations of these terrain tiles so that the player can feel more immersed in the game as the scenery won't be identical in each area of the map.

## December 2015

### Tuesday the 1st of December

**Action:**

Meeting with supervisor at 10am, and discussed the progress that had been made with the terrain tiles. We then discussed the parts of the interim report that I was unsure about and how to improve upon the previous report.

**Planning:**

Until the 11th of the of December when the interim report is due in, all of my time will be dedicated to completing this report. The report will consist of five sections: Project Goals, Literature Review, Methodology, Project Progress and the Project Plan. I will complete these sections in this order.

### Wednesday the 2nd of December

**Action:**

Started working on the Project Goals section by writing out all of the main project goals.

### Thursday the 3rd of December

**Action:**

Continued working on the Project Goals section by writing out all of the secondary goals and finalising the main goals section.

### Friday the 4th of December

**Action:**

Completed the Project Goals section.

Wrote out the literature review section.

### Saturday the 5th of December

**Action:**

Wrote out the Methodology section.

### Sunday the 6th of December

**Action:**

Started working on the Project Progress section.

### Monday the 7th of December

**Action:**

Completed the Project Progress section.

### Tuesday the 8th of December

**Action:**

Started working on the Project Plan section.

### Wednesday the 9th of December

**Action:**

Completed the Project Progress section, and went back over the rest of the document making corrections.

### Thursday the 10th of December

**Action:**

Meeting with supervisor at 12am, I asked him to try and clarify a few things in about the interim report that I was unsure about.

Made changes and additions to the interim report based on the advice of my supervisor.

### Friday the 11th of December

**Action:**

Made few last minute changes and submitted the final version of the Interim Report.

### Wednesday the 16th of December

**Planning:**

The next step is to create the terrain generation algorithm however before I can create that I need a way to view the terrain so that I can tell whether the generation was successful. So I will spend some time creating the implementation for rendering the terrain.

**Action:**

Started implementing the terrain by creating a texture wrapper class so to give increased functionality to textures over the base SDL implementation.

### Thursday the 17th of December

**Action:**

Added functionality to load each of the terrain tiles into the game so that they can be displayed.

Started creating an implementation for displaying the terrain to the user.

### Tuesday the 29th of December

**Reflection:**

I managed to find a lot less time over Christmas to do work than I had expected and as such am now a behind where I expected to be.

**Action:**

Made some changes to the implementation of the character movement so that the movement is frame independent and based off of a timer.

### Thursday the 31st of December

**Action:**

Continued working on the implementation of terrain rendering.

## January 2016

### Friday the 1st of January

**Action:**

Completed the rendering of terrain.

### Monday the 18th of January

**Reflection:**

Due to an assignment and unforeseen circumstances I have been unable to complete any work on the project for the last few weeks.

**Planning:**

Now that the terrain can be rendered I have decided that it is a good time to start implimenting the 2.5D view that the overall game will be seen in.

**Action:**

Started the implementation of the 2.5D view by attempting to transform the coordinates of each block by a different amount, this did not work so I have started researching how this effect is achieved in other games.

### Wednesday the 20th of January

**Action:**

Continued working on the 2.5D implementation I have been unable to find any information on how to display in 2.5D.

### Monday the 25th of January

**Action:**

I located an algorithm for converting 2D coordinates to 2.5D coordinates. Using this I am able to achieve a view that is similar to what I wanted to achieve so shall persist with this.

### Tuesday the 26th of January

**Action:**

Meeting with supervisor at 12 am. We discussed the feedback from the interim report.

We also discussed my progress with the project, and that there is no progress with the procedural generation of terrain, and that this should be my priority at the moment.

**Planning:**

As I am close to finishing the 2.5D display I find it hard to move onto terrain generation and as such plan to finish the 2.5D display as soon as possible and then move onto the terrain generation.

### Friday the 29th of January

**Action:**

Finalising the 2.5D display by resizing the textures so that they fit together with no gaps with the 2.5D coordinates.

### Sunday the 31St of January

**Action:**

The 2.5D display is now fully functioning.

## February 2016

### Tuesday the 2nd of February

**Action:**

Meeting with supervisor at 12pm. He gave advice as to how to go about generating the terrain.

### Wednesday the 3rd of February

**Action:**

As it was not possible to move around in the terrain previously, which would mean it wouldn't be possible to tell whether the terrain was being generated properly I decided to spend today implementing the character movement around the terrain so that it was possible to view the terrain that is generated.

Due to complications with the movement I have chosen to abandon the 2.5D display for the moment. I plan to try to finish this off and make the game display correctly after I have finished implementing the terrain generation.

The movement system has been implemented, however it does not take account of the 2.5D display so the movement system will have to be updated when the 2.5D display is reimplemented.

Fixed graphics glitch with the clearRenderer function.

### Thursday the 4th of February

**Planning:**

The next step is to create the terrain generation, I will start by creating an ocean around a central island as the basis for the games terrain. This means that each time the a new game map is created it will always be a single large land mass surrounded by water, this is important as it gives a natural barrier to stop the player from leaving the map.

### Saturday the 6th of February

**Action:**

I started the creation of the ocean generation function. I did this by having a boarder of ocean tiles a th the edge of the map. This gave a very linear transition between the ocean and the landmass terrain. And as such I am now trying to combine the two using random numbers so that it is not just a single line transition.

### Sunday the 7th of February

**Action:**

The random numbers were not giving a very good result, as such I have decided to try implementing Perlin Noise and incorporating this in the generation, as this should give a non-linear transition.

### Monday the 8th of February

**Action:**

The ocean is now being created to a nice effect using Perlin noise, and I started adding beaches after the ocean tiles to give a more natural look. This uses the Perlin noise as well however there is now a a linear transition from the beach to the normal terrain.

**Reflection:**

The ocean generation has advanced a lot, and since I started using noise rather than random numbers to create it the game has started to look a lot better. I still need to move faster than I am currently, however the generation is a much more complex problem than I had previously anticipated it to be and as such my progress is slow.

### Tuesday the 9th of February

**Action:**

Meeting with Supervisor at 2pm. He reiterated that I need to speed up my development of the terrain generation and the game in general.

**Planning:**

As the ocean and beach generation has been completed I have decided to move onto the landmass generation, once this is completed I will work to combine the beach and landmass so that there is a non-linear transition.

### Wednesday the 10th of February

**Action:**

I started the landmass generation by creating different thresholds for the noise values, this has created and effect similar to something that resembles natural terrain.

### Friday the 12th of February

**Action:**

Over the last few days I have made little progress with making the terrain look appealing or useful within the confines of the game. The terrain seems to be very sparse, and in order to make it so that there are more features within a smaller area I have decided that I should use multiple noise generations and then combine them together at the edges.

### Sunday the 14th of February

**Action:**

Combining the terrain blocks together at the edges is not going as planned I can't seem to get the terrains to blend, as rather than looking line one is feeding into the other there seems to be a band between the blocks that is its own separate terrain.

### Monday the 15th of February

**Action:**

I have completely overhauled the landmass generation code however I am still having exactly the same problems of being unable to combine the blocks of noise.

### Thursday the 18th of February

**Action:**

I have finally managed to get the terrain to look how I wanted it to. This was achieved by returning to the original implementation of the landmass code and rather than getting noise values between the values of 0 and 1 from the start of the terrain to the end of it, a constant value was applied to the x and y values accessing the noise. This meant that the terrain was not stretched according to the size of the landmass, but was kept with a constant amount of features.

I worked out that this was how to achieve what I wanted when I was changing the size of the terrain overall to see what effect this would have, and it made the features either closer together or farther apart.

### Wednesday the 24th of February

**Reflection:**

Now that the landmass generation is completed I am closer to finishing the terrain generation, however it took far to long to complete.

**Planning:**

The next step is to combine the beaches and the landmass so that there is a non-linear transition.

**Action:**

I have tried using a gradient to make is to that the edges of the terrain are always lower than the surrounding areas, meaning that the ocean and beaches can be added to the general landmass generation. The combination is working to an extent however ocean is now being created in the middle of the landmass and this is not something that I want to happen.

### Thursday the 25th of February

**Action:**

To fix the ocean being generated within the landmass I have set a limit so that ocean can only be created so far into the terrain, and another limit after that for the beach. This seems to be working very well and is producing some nice terrain.

**Reflection:**

The base terrain is now finally completed and as such it is time to move onto some new features of the game.

**Planning:**

There is a need to add animation to the player character as at the moment it floats around the map. As such I plan to create some sprites that can be used for said animation.

### Friday the 26th of February

**Action:**

Sprites have been created, and I will work to implement them in the game.

### Saturday the 27th of February

**Action:**

The movement animations have now been implemented into the game so the character looks like it is actually moving when it is.

### Sunday the 28th of February

**Action:**

Worked on open day poster and abstract.

### Monday the 29th of February

**Action:**

Further work on poster and abstract

## March 2016

### Tuesday the 1st of March

**Action:**

Meeting with Supervisor at 4pm.

Completed the open day poster and abstract.

**Planning:**

Now that the terrain generation base is completed I will next fix any errors that come up when the terrain is generated, specifically one where if you move over the edge of the terrain the game will crash with a segmentation fault.

**Action:**

To fix the errors when moving off of the terrain map, I added a check when rendering each tile so that if a tile is off of the terrain map, the tile is rendered as ocean this solves the previous issue.

### Wednesday the 2nd of March

**Planning:**

The next stage in the development of the game is hit detection with the map, so that the player cannot move over certain types of terrain, specifically ocean and water tiles.

**Action:**

To add the hit detection the position of the character on the terrain had to be recorded in the character class, so this has to be calculated to start with as previously the character was just rendered at the centre of the screen. Now the player is rendered at a position that is slightly off centre but is now within a square on the grid.

To check whether the character should be able to move over the terrain, each tile is checked in advance when a movement is requested, if a type it can move over then the character moves onto the square, otherwise the movement it blocked.

### Thursday the 3rd of March

**Planning:**

The next objective is to make add details to the terrain that the player can interact with, such as towns. I will first work on adding details to the terrain like trees, and then will move onto placing towns onto the map.

**Action:**

The first step was to add all of the new textures to the media sections of the game. Once this was done the next step was to add rendering of these new textures to the render functions of the game. As these new textures would be using a separate array all that was needed was to add this second array to the render functions.

### Friday the 4th of March

**Action:**

Now that the rendering of the terrain details has been added the next step is to move onto placing trees and waves on the ocean tiles.

Adding trees required a loop over the entire terrain, within this loop each tile was checked and if it was a type of terrain that could have a tree placed on it, a random number was created and if the random number was above a certain threshold a tree was placed. I also added functionality to create forests, so on certain terrain types if there was a tree already placed there was a much higher likelihood of a tree being placed next to it.

The next step was to add ocean waves, this was done in the same way as trees, where if there was an ocean tiles there was a small chance of a wave being placed, and if there was a wave placed in an adjacent tile there was a higher likelihood of one being placed in the tile.

After these details were added I noticed there was a problem with rendering the terrain details as some of the textures were 32x32 and others were 16x16, to fix this I added a check for the size of the texture. Then depending on the size it was rendered with a different offset.

**Planning:**

The next step is to add towns to the map. To increase speed of development I removed the requirement for hidden towns so that there are only 4 towns placed on the map, one in each quarter of the map and each on a different terrain type.

**Action:**

Towns were added on lakes, to do this a loop through the terrain was completed and if there was a suitable lake found a town would be placed in it.

### Saturday the 5th of March

**Action:**

The town placement was completed, and one town is placed in each quarter of the map. Each is placed on a different terrain type.

### Monday the 7th of March

**Planning:**

The next step is to add roads to the terrain between the towns, I will attempt to add roads automatically using A\* search to find the shortest path between two towns and then move onto having a road between each town.

**Action:**

The first step was to create a class for nodes in the search, each node holds its own X and Y coordinates, as well as the previous node. The next step was the creating the heuristic function, as the movement could only be in 4 directions in the grid I decided to use the Manhattan heuristic.

After working on the search for a while I finally got it to work correctly, I had problems with the pointers in C++ but this was solved by dynamically creating the pointers rather than allowing the language to create them for me. This meant I had to add functionality to delete the pointers once they were finished with as this would not be done automatically by the language.

The search is almost complete, there just need to be a few adjustments and it will be completed.

### Tuesday the 8th of March

**Action:**

Meeting with supervisor at 2pm. We discussed what features were most important to be finished before the open day, and in accordance with what was on my poster the features of, enemy characters and quests were seen as the most important parts.

**Planning:**

I shall continue and finish the A\* path finding code as this will be required by enemy characters as well for road placement on the map. Once this is completed I shall work on the enemy characters and then on implementing quests. I shall also try to implement a levelling system so that enemy characters grow with the player.

**Action:**

I continued to fiddle with the A\* path finding code to improve it so that it is more efficient as at the moment it takes far longer than it should to complete.

### Wednesday the 9th of March

**Action:**

I have improved the search function so that it now works much faster than it did previously, allowing for it to be used for the enemy pathfinding.

### Thursday the 10th of March

**Action:**

Completed the placement of roads onto the map, the final touch to roads is to add the bridge textures so that it looks nice when they go over water.

### Friday the 11th of March

**Action:**

Finalized road placement and bridges completely. Fixed the randomisation seeding so that it is only seeded once in the program.

### Saturday the 12th of March

**Action:**

I started working on the characters other than the player. To do this I created a character superclass which will have the base methods and attributes that are to be inherited by all characters. I then created the enemy character super class which will be inherited by all the different enemy characters.

In the Enemy character class I created functions for movement and rendering. The rendering takes account of the players movement offset so that while the player is moving the enemy characters look like they're position is relative to the player.

The collision detection with the terrain was moved to the update class so that it can be used with all of the characters and not just the player.

As the amount of files in the program is starting to get quite large I decided that my current file structure was not sufficient so I moved all of the code files around so that all of the classes and functions that relate are in their own directories.

Added in movement using the WASD keys rather than just the arrow keys so that in the future more buttons will be usable in the game.

As the enemy characters will need pathfinding so that they can attack the player, the A\* pathfinding algorithm has been moved from the terrain generation class to its own class so that it can be used by the enemy characters as well as the terrain generator. This also means that the class was generalised so that it is no longer specific to terrain generation.   
  
As part of the generalisation the pointers used in the A\* algorithm have been updated from being raw pointers to smart pointers, this means that there should be no memory leaks when the class is destroyed as there was a problem with where to delete the pointers previously.

### Sunday the 13th of March

**Action:**

Hit detection was added for characters, so that they won't move through each other. And an attack was also added that uses this hit detection, to make sure that the character is next to the other characters as to make sure the hit is valid.

The player character class was modified to inherit from the main character super class.

The way that the user inputs are tracked was modified so that holding down a key works correctly.

Two specific enemies were added, the Slime and the Blob enemies. These have different images and each have different statistics. For instance the Slime has a much higher defence but a much lower attack and health.

Added an attack to the player class and added the mouse button press to the user inputs so that the player attacks when the mouse button is pressed.

A delay between attacks was added to all characters, this is done using a timer and a constant. In future this may be updated to be a variable so that the delay between attacks can be changed for gameplay reasons.

Started work on the UI so that the player can tell what their level is, how much health they've got and to show other information to them. A health bar was also added for the enemy characters.

The hit method was changed so that when a character is hit with an attack it always takes at least 5 damage as the damage taken may be less due to the way the defence value interferes with the damage taken.

Experience points were added to the enemies so they now drop an amount of experience points for the player to level up with when they are killed by the player. Levelling was also added to the player so that when they kill a certain amount of enemies they level up and their statistics increase.

The players spawn position has been moved to always start in the top left corner at the town in that quarter.

### Monday the 14th of March

**Action:**

The hit function has been edited so that it returns whether the character is still alive after the damage is taken.

Health regeneration was added to the player, this was done with a timer, so that after a certain amount of time their health gets replenished. I certain amount is replenished each time and they can only be replenished to their maximum health.

Quests have been added so that the player now has an objective to complete in the game.

### Tuesday the 15th of March

**Reflection:**

In the last few weeks I have made significant progress towards finishing the game or at least getting it to a playable state. I feel that I have achieved all the goals that I set out to do in this time period and hope that going forward I also continue to make as much progress.

**Action:**

Meeting with supervisor at 2pm. He recommended that I make sure I have a zoom out function, where the players view point gets scaled out so they can see more of the terrain, this is for both the players benefit and for the benefit of being able to show of the terrains details on a larger scale.

**Planning:**

The next stage of the project is to

### Thursday the 17th of March

**Action:**

I changed the tree textures as the ones that I was using were placeholders until I managed to finish the designs.

I fixed an issue with the levelling up of enemies when the player levelled up as it appears that they were not levelling up when the player levelled up.

### Tuesday the 22nd of March

**Action:**

Corrected a few issues with the players hit detection. Now the player cannot move through other characters.

Tried to make the pathfinding more efficient and better so that it can avoid water.

### Friday the 25th of March

**Action:**

Reverted the pathfinding back to the original version, as this works and the time frame doesn’t allow for me to spend too much time working on optimisations of a single feature.

### Saturday the 26th of March

**Action:**

Started working on the zoom feature, this will allow for the player to zoom out, letting them get a better look of the map and where everything is.

### Monday the 28th of March

**Action:**

Added the rendering of different size blocks to all of the rendering functions. This means that to zoom out all that is needed is to change the global variable of block width and everything is rendered to scale with the change.

### Wednesday the 30th of March

**Action:**

Started working on the final report.

### Monday the 4th of April

**Action:**

Finished the zoom out feature. I decided to make it so that the game pauses when the player zooms out, so that they can concentrate on the map rather than any enemies that are attacking or closing in on them.

### Sunday the 10th of April

**Action:**

Continued working on the final report.