**Third Year Project – Progress Handbook**

This handbook is a way of documenting what work I have completed throughout the year, what I need to work on next, resources that I have used and supervisor meeting notes. It will also be used as evidence for the progress on the project.

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# Summary of Progress

## Semester 1

|  |  |
| --- | --- |
| **Week** | **Work Completed** |
| **<-1** | Completed preparation work before beginning of semester – Read through several articles, websites, watched videos and tutorials related to Blackjack. |
| **1** | First lecture on project proposal and began looking at research papers. |
| **2** | Worked on getting to grips with latex, writing the project proposal and first meeting with supervisor. |
| **3** | Refinements to project proposal as suggested through feedback + lecture on literature review. |
| **4** | Reading through research and writing literature review. |
| **5** | Continued working on literature review and researching |
| **6** | Literature Review Meeting and Feedback |
| **7** | Made improvements to literature review from feedback |
| **8** | Worked on design and simulations plan |
| **9** | Worked on design and simulations plan |
| **10** | Writing of progress evidence and evaluation |
| **11** | Writing of progress evidence and evaluation + Adviser feedback and meeting |
| **12** | Finishing off and submitting progress and evaluation report |

## Semester 2

|  |  |
| --- | --- |
| **Week** | **Work Completed** |
| **<-1** | Some research was completed during the winter break before the beginning of the second semester. |
| **1** | Started writing up the classes needed for the simulations |
| **2** | Continued work on simulations program |
| **3** | Finished off writing of the simulations program |
| **4** | Ran the simulations, discovered some errors, and adapted the code thereafter |
| **5** | Ran the simulations again and this time everything was working correctly |
| **6** | Began analysing results and trying to find any trends and patterns |
| **7** | Finished off initial analysis of the results, and began thinking about the final report |
| **8** | Started working on the final report |
| **9** | Continued working on the final report |
| **10** | Developed new card counting methods using some previous research data |
| **11** | Finished off the final report after listening to some suggestions and correcting any spelling and grammar mistakes |
| **12** | Worked on finishing off all supplementary material |
| **13** | Submitted all the work and began working on a website where I can showcase my results etc. |

# Progress Details – Semester 1

## Prior to Week 1

Overall, the weeks prior to begin the semester were all about learning the rules of blackjack and all the finer details of the game. It was crucial to get a head start and really understand the game, so I was better prepared and able to think about ways of converting the game to code.

### What was completed

* Learnt a lot about what blackjack is, how its played, what card counting is and some history.
* Learnt the rules of blackjack, all the possible ways they vary including the reasons why they are different in different casinos and how it affects the game
* Learnt what basic strategy is, how to use it and the other methods that can be used i.e., never bust
* Learnt about the casino advantage and how different rules change the odds.
* Played through several games myself to fully understand the game and think about how it can be implemented using code

### Resources

* <https://www.blackjackapprenticeship.com/> - All the relevant information for beginners to get the grips of the game
* <https://www.youtube.com/user/bjavideos> - Blackjackapprenticeship YouTube Channel
* <https://en.wikipedia.org/wiki/Card_counting> - Card counting information
* <https://bicyclecards.com/how-to-play/blackjack/> - Rules of the game
* <https://www.247blackjack.com/> - For practicing

## Week 1

This was the first week of the semester and the first lecture. I had to begin work on the project proposal and get familiar with latex

### What was completed

* Got to grips with latex and worked through several tutorials
* Used a few more resources to learn even more things and refresh memory
* Began looking at already completed research on blackjack simulations
* Worked on writing up the project proposal and creating a Gantt chart.

### Resources

Hsu, W.-J. and Chie, B.-T. (2021). How do advantage players exploit casinos’ premium offers? simulations and solutions. International Gambling Studies.

## Week 2

This second week was very similar to the last as I continued working on the project proposal and using latex. I also had a meeting with my supervisor at the end of the week.

### What was completed

* Had a meeting with supervisor to discuss the project and received feedback on project proposal
* Got to grips with latex and worked through several tutorials
* Used a few more resources to learn even more things and refresh memory
* Began looking at already completed research on blackjack simulations
* Worked on writing up the project proposal and creating a Gantt chart.

## Week 3

This week was spent working on refinements to the project proposal and began looking at available literature on blackjack and simulations for it.

### What was completed

* Worked on refinements to the project proposal after receiving advice from my supervisor
* We also had a lecture on the literature review to give us some advice and answer questions.

## Week 4

Finding and reading through research relevant to the literature review and began writing it up.

### What was completed

* Finding all of the actually relevant research that I can use for the review
* Reading through the found literature
* Beginning to write the literature review

## Week 5

Continued working on the literature review.

### What was completed

* Reading through the found literature
* Continued to write the literature review

## Week 6

Had another meeting with supervisor on my initial literature review and made improvements from the feedback

### What was completed

* Had meeting with adviser (more details can be found in meetings section)
* Made changes to literature review

## Week 7

This week I sent the refined literature review and received some more feedback and discussed the simulations plan

### What was completed

* Had meeting with adviser (more details can be found in meetings section)
* More changes to literature review

## Week 8

Began work on design and simulation plan.

* + 1. **What was completed**
* Though about the number of simulations I want to perform
* Decided which simulations are most relevant and useful
* Thought about possible ways of doing the simulations

## Week 9

Continued working on design and simulation plan.

* + 1. **What was completed**
* Created a UML diagram for the code of the simulations
* Wrote out the initial simulations plan
* Researched simulations method further and how data can be used

## Week 10

Began writing of progress evidence and evaluation

### What was completed

* Created a structure to the file
* Started writing out all of the relevant information and putting the design and planning together

## Week 11

Continued work on the progress evidence and evaluation

### What was completed

* Worked on writing the review and conclusion part of the report
* Had a meeting with adviser
* Made changes from the feedback received

## Week 12

Finishing off details and submission of the progress and evaluation report

### What was completed

* Finished off small part of the report
* Submitting this handbook and the report

# Progress Details – Semester 2

## Prior to Week 1

Some research was completed during the winter break before the beginning of the second semester.

### What was completed

### Looked at possible implementations of the program for the simulations

* Began working on some code as practice for the real implementation

## Week 1

Started writing up the classes needed for the simulations

### What was completed

* Class structure was written Card, Deck, Player, Computer, Game, Hand
* Coded functionalities: Creating a card, creating a deck, creating a shoe, shuffling, dealing cards,

## Week 2

Continued work on simulations program

### What was completed

* Implemented Basic Strategy along with Never bust and Mimic the dealer strategies
* Implemented and test a game playing scenario: dealing cards, taking turns, changing bet size etc.

## Week 3

Finished off writing of the simulations program

### What was completed

* Implemented card counting methods into the simulations
* Wrote code to loop through various simulations
* Ensured no part of the simulations was missing
* Tested the program multiple times before starting the actual simulations

## Week 4

Ran the simulations, discovered some errors, and adapted the code thereafter

### What was completed

* Tried running the simulations for all conditions that are being simulated, but discovered a couple of issues with the results that were produced
* The program was not correctly changing the bet size
* The program was also not correctly playing the amount of deck penetration specified
* Fixed the issues before trying to run the software again

## Week 5

Ran the simulations again and this time everything was working correctly

### What was completed

* Completed all the simulations and stored the results
* Started looking at factors and analysis techniques.

## Week 6

Began analysing results and trying to find any trends and patterns

### What was completed

* Analysis of many factors that include game strategy, number of decks, S17, H17, different deck penetrations, betting systems, counting methods etc.
* Produced many graphs and tables to showcase results.

## Week 7

Finished off initial analysis of the results, and began thinking about the final report

### What was completed

* Added a small number of new graphs and tables
* Changed structure and design of graphs to make them clearer for the report
* Thought about what to write in the report

## Week 8

Started working on the final report

* + 1. **What was completed**
* Began working on the final report structure and content
* Wrote out the following sections: Introduction, Blackjack, Strategies, Card Counting, Implementation
* Completed most of the Simulation Results which is the main portion of the analysis

## Week 9

Continued working on the final report

* + 1. **What was completed**
* Completed the Simulation Results section and Further analysis
* Began looking at developing new card counting methods

## Week 10

Developed new card counting methods using some previous research data

### What was completed

* Developed two new card counting methods: one very complicated, and one much simpler
* Ran simulations under all previous conditions for the new card counting methods
* Analysed the results of the new card counting methods and began writing for the report

## Week 11

Finished off the final report after listening to some suggestions and correcting any spelling and grammar mistakes

### What was completed

* Finished off any missing sections
* Wrote a conclusions
* Ensured nothing was missing from the report and corrected spelling and grammar mistakes

## Week 12

Worked on finishing off all supplementary material

### What was completed

* Included all graphs and result files in a folder to be submitted
* Cleaned up and commented code
* Wrote a README file

## Week 13

Submitted all of the work and began working on a website where I can showcase my results etc.

# List of Supervisor Meetings

## Meeting 1

### Overview

The first meeting was a way for us to introduce ourselves and to discuss the project as a whole and how we will proceed. We talked about what my motivation is and more broad topics to do with blackjack and how simulations can work. I received some feedback on my project proposal which included the following improvements:

### To do list

* Changing the aims from a to do list and decided a more specific aim
* Changes to the motivation and goals of the project

## Meeting 2

### Overview

This meeting was mainly focused on the literature review and feedback for that. We also talked about the next step.

### To do list

* Specify what the research has exactly found with some relevant data
* Have a more critical review and say what was missing

## Meeting 3

### Overview

This meeting was to talk about the progress and evaluation report and how it was going. There were several things to the plan that needed adjustment and further explanation

### To do list

* I need to decide the number of hands for each simulation
* All information needs to be explained to a full extent on graphs and diagrams
* Considered data to be collected i.e., a measure of location, median, standard deviation, quartiles, min-max, percentage points
* Need to record wins and losses
* State that the player will be allowed to borrow money i.e., go into negative balance
* Need to say the seed will be recorded

## Meeting 4

### Overview

In this meeting we discussed some of the results that I have produced and noticed some of the mistakes and errors

### To do list

* Found errors in the simulations code that needed to be fixed
* Fix deck penetration issue where it doesn’t deal the right number of cards out
* Fix betting issue where it is not placing the correct bets when card counting

## Meeting 5

### Overview

In this meeting we discussed some of the analysis that I had performed after fixing the issues I had with the code and running the simulations again. Some further detailed analysis is required

### To do list

* I already had a good starting point for the analysis, but more graphs and information were needed
* Include some other graphs and try to find anything new and out of what is already planned

## Meeting 6

### Overview

In this meeting we discussed the final report and what are the sort of thing I would need to talk about

### To do list

* Good explanation of the blackjack terms
* Detailed explanation of the simulation design
* Ensure only relevant and accurate figures are included in the report
* Include only what is mentioned and discussed anything that is not relevant should be moved to appendix
* A very detailed analysis

## Meeting 7

### Overview

Some further updates on how the final report is going and some pointers in the right direction

### To do list

* Ensure present not future tense is used in the abstract and intro
* Improve figure references and captions
* References should be put in brackets