MSc IT+ Masters Team Project

Group 19
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1 Introduction

This report will summarize the main points describing the process of making a software product for a Top Trumps game in Java.

It starts off with an outline of the preliminary work required to initiate the work, including the requirements analysis as identified by the team, Sprint planning for both the Command Line and Online modes of the game, and also Burndown Charts reflecting remaining story points as a function of time with expected and actual measurements.

It continues with a section about the assumptions made for the implementation of the product and a chapter summarising the functionality, game logic and database behaviour for both modes.

Details of testing for each story with corresponding results follow after that, as well as a section about the current state of the program, under the deficiencies section.

Finally, the appendices contain information about the minutes of meetings (Appendix A), the customer specification defining the requirements (Appendix B), flash cards with final User Stories with descriptions and acceptance tests (Appendix C), and concludes with supporting screenshots that are referenced throughout the report (Appendix D).

2 Development Process

2.1 Requirements Analysis

Prior to generating user stories, the team took a disciplined approach to mapping out requirements. Functional and non-functional requirements were extracted from the provided specification document (ITSD2018-TaskDocument), and a "customer specification" was produced, which formed the basis for generation of user stories. Each requirement is given a unique requirement ID, allowing individual requirements to be discussed without confusion, and to allow cross-referencing with user stories.

A copy of the customer specification is provided in Appendix B.

2.2 User Stories

An initial set of user stories were brainstormed by each team member and posted on a Trello board. Reference is made to Appendix A.2 for minutes of the initial planning meeting, where user stories were finalised. To ensure full coverage of requirements, a coverage matrix was produced to give the team confidence the main aspects were captured (see Figure 12).

The final set of user stories can be found in Appendix C.

2.3 Design

An initial design meeting was held to agree overall technical approach. Reference is made to Appendix A.3 for further details. Since this meeting, the design evolved as the team got more familiar with the design challenges.

This section communicates the final design. Where possible, the team implemented common design patterns in an effort to reduce coupling and to follow best-practices. Overall architecture makes use of the MVC pattern, applied per Figure 1.

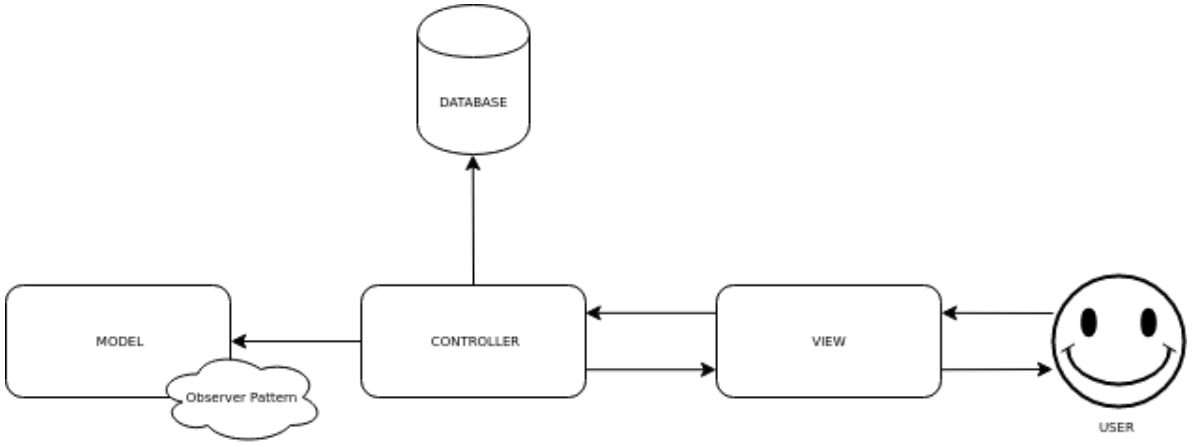


Figure 1: System Architecture

The model and database components were designed to be used by either the command line or online modes of the system:

- Model (`package model`, see Figure 2 for UML):
  - Encapsulate game actions and game state.

  - Be agnostic to the implementation of other parts of the system. Apply the Observer Pattern to eliminate any need for the model to be aware of external components, reducing coupling. Passively notify interested parties of changes to game state.
  - Provide a set of public methods to trigger key game actions (Facade Pattern) (`GameAPI.java`).
  - Provide a Immutable Parameter Object to extract a snapshot of key game data from within the model, allowing a single "info" object to passed to other parts of the system (`GameInfo.java`).

- Database (`package persistence`, see Figure 3 for UML):
  - Provide a set of public methods to write key game information to a persistent database.

A specific controller and views were created for command line mode:

- Controller (`package commandline`, see Figure 4 for UML):
  - Provide game management and logical flow, specific to the command line implementation .
  - Serve views to user, and trigger necessary game actions.
  - Trigger game events based on game state (via Observer).
  - Limit coupling with model by calling `GameAPI.java` methods only.
- View(s) (`package commandline`, see Figure 4 for UML):
  - Provide command line output and facilities to retrieve user input, specific to the command line implementation.
  - Limit coupling by communicating only with the controller.

For online mode:

- Controller (`package online`), see Figure 5 for UML):
  - Provide game management and logical flow, specific to the online implementation.
  - Provide APIs for the user to interact with the Game logic via the web page views.
  - Trigger game events based on user interaction via web pages (i.e. API calls).
  - Limit coupling with model by calling `GameAPI.java` methods only.
- View(s) (`package online`), see Figure 5 for UML):
  - Provide output and receive user input via (.ftl) web pages specific for the online implementation.
  - Coupling limited by freeing the web pages from interacting with the Game logic.

The interaction between all packages is captured in Figure 6. The native image is also provided with the team .zip submission for readability.

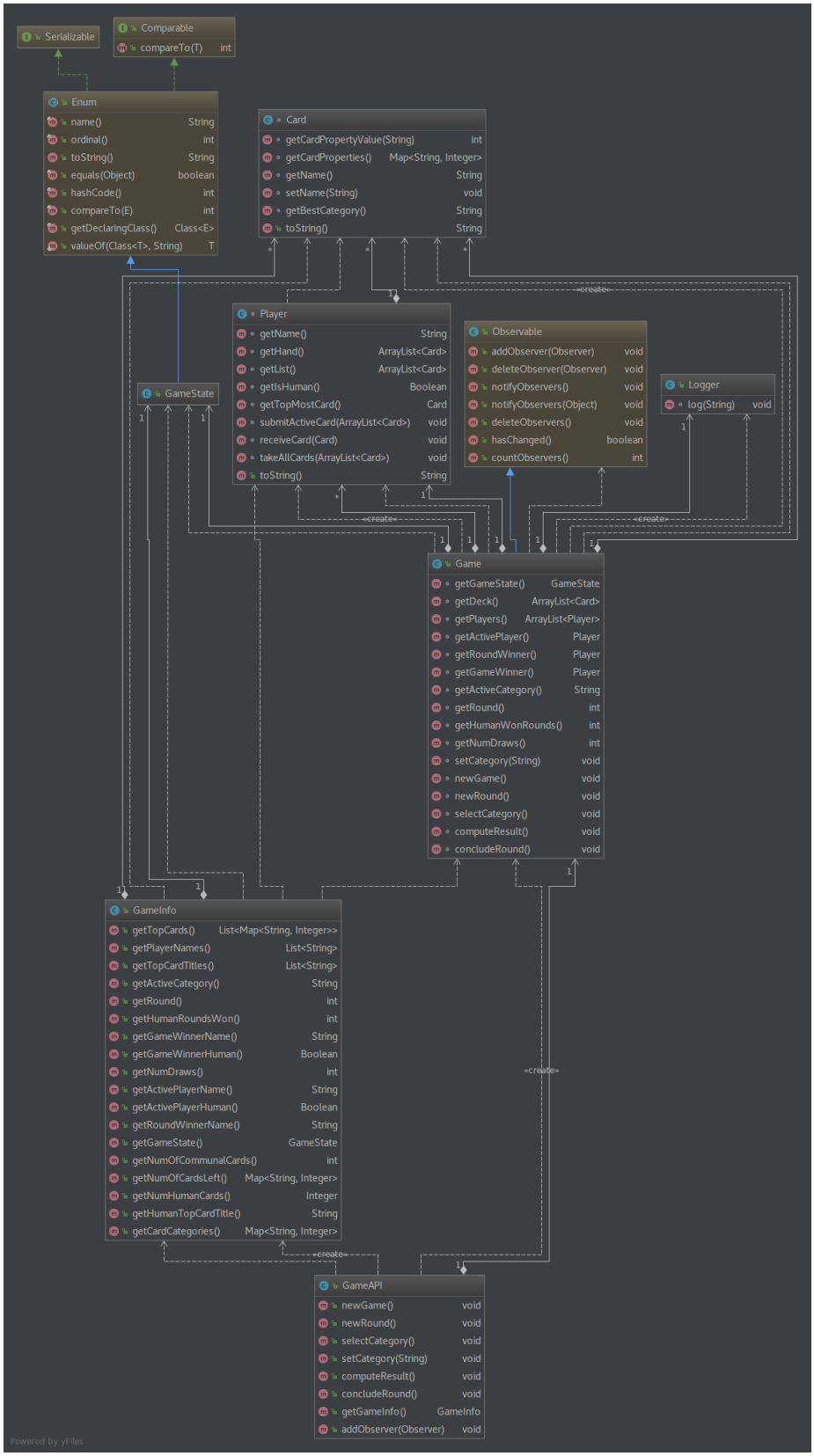


Figure 2: Model Package UML (Package Visibility)

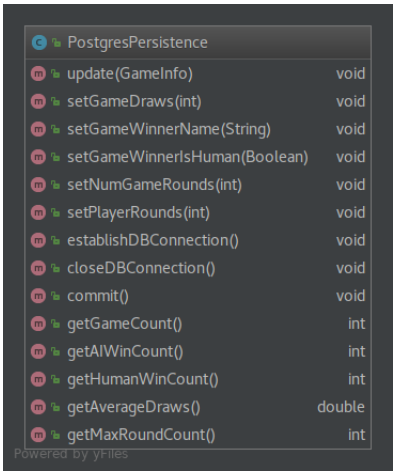


Figure 3: Persistence Package UML (Package Visibility)

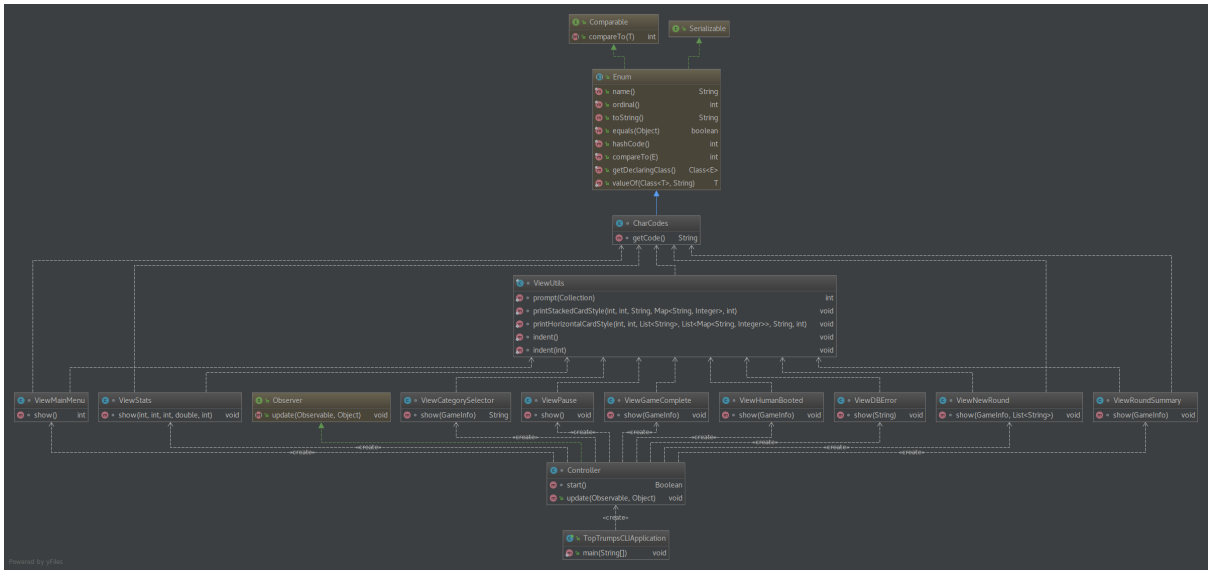


Figure 4: Commandline Package UML (Package Visibility)

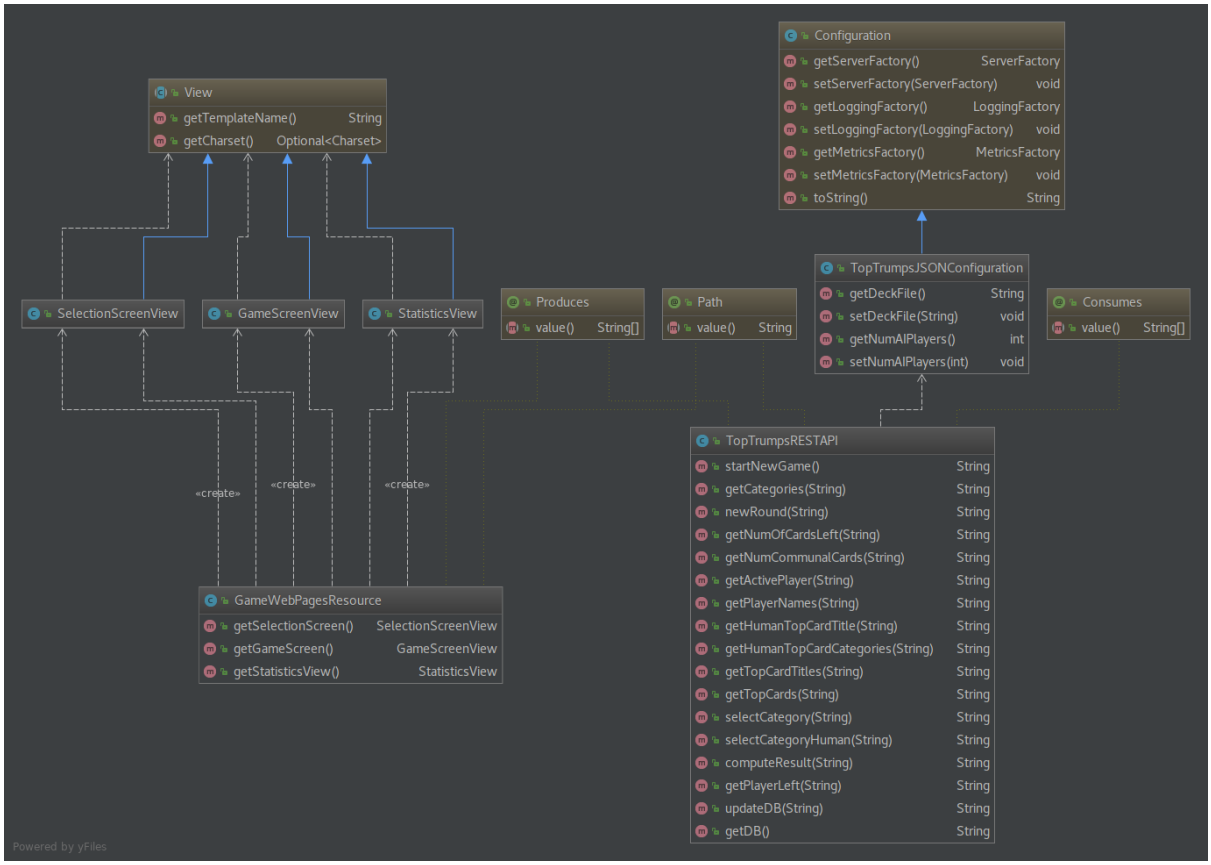


Figure 5: Online Package UML (Package Visibility)

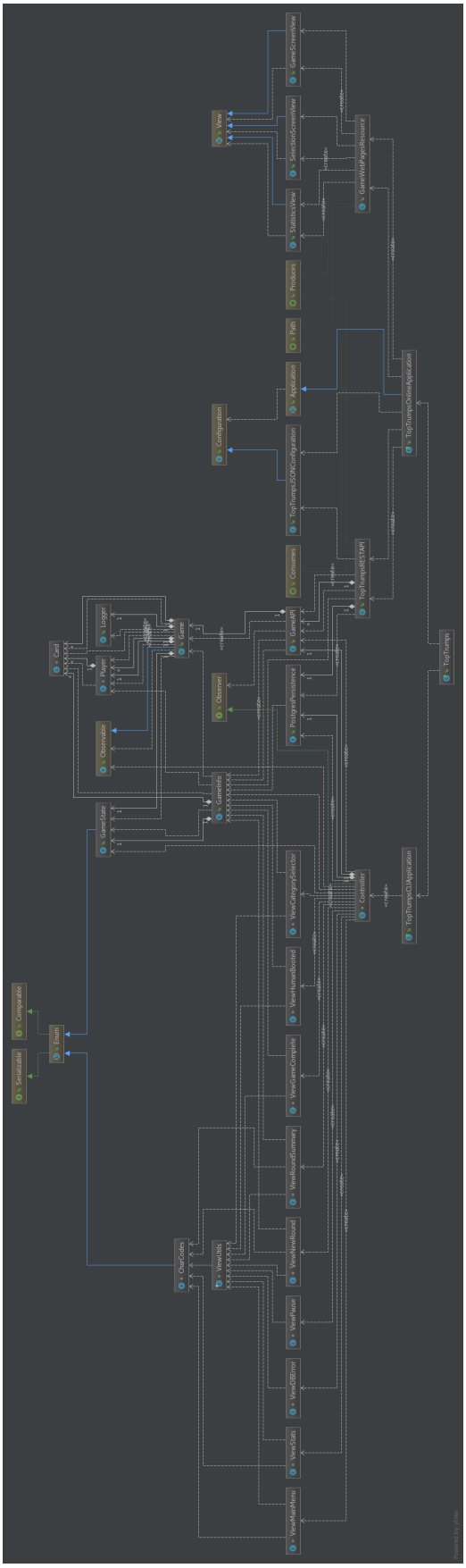


Figure 6: Full System UML.

2.4 Sprints

2.4.1 Sprint #1

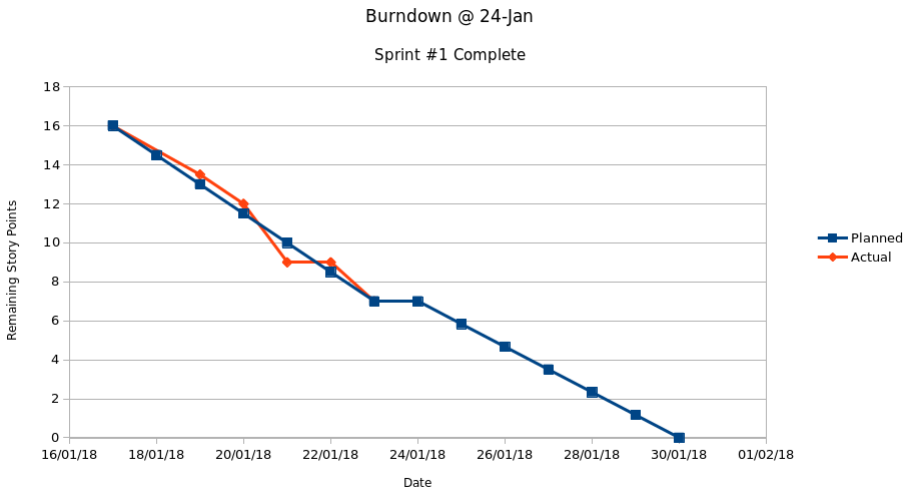


Figure 7: Burndown Chart Sprint #1

The upfront design work paid dividends during Sprint #1, resulting in steady progress during implementation. As noted in Appendix A.4, some stories took longer than anticipated to complete, however the team stepped-up efforts to complete all stories within the iteration.

2.4.2 Sprint #2

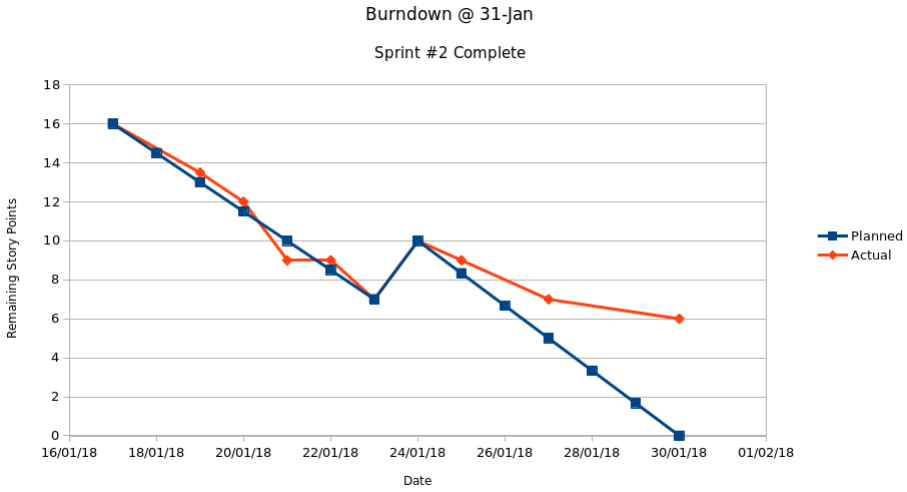


Figure 8: Burndown Chart Sprint #2

Sprint #2 proved to be a challenge, due to the team's overall lack of experience with the online technologies, and the impact of some early design decisions. During Sprint #1, the model (specifically the `Game` class), was implemented in a way that relied on a single flow of events, with most game logic being contained in a single method. When the Observable `notify()` method was called at key stages to change `gameState`, execution was blocked, passing execution over to the controller where the event was handled. Upon

completion of the controller flow, execution was handed back to the model where the logic continued.

However, due to the asynchronous, stateless nature of the online technologies, this blocking mechanism was no longer available. The solution was to refactor the model to create individual methods for each segment of game logic, which would be triggered by the controller as needed. The impact was that most stories could not be completed within the iteration, and a third sprint had to be scheduled.

Appendix A.5 has further details.

2.4.3 Sprint #3

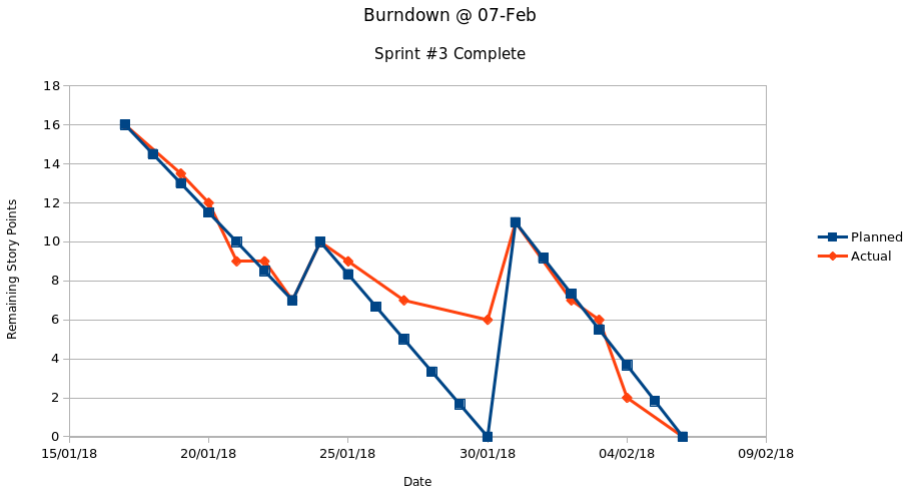


Figure 9: Burndown Chart Sprint #3

Sprint #3 successfully solved the issues encountered previously, and the project came to a functional conclusion at the end of the iteration.

Appendix A.6 has further details.

3 Technical

3.1 Assumptions

The following section contains an outline of the assumptions that have been made during the development of the product, assumptions that the prospective user should keep in mind.

When players have only one card in their individual decks and the outcome of the current round is a draw, then they lose the game as their cards go to the communal deck of cards. This means that, if the game has only two players left and the above scenario happens, then the winner ends up having less than the total of 40 cards in hand.

Another assumption is that in the case of a draw, the next stage of the game is considered to be a new round and not an extension of the draw round. Last winner player will still choose the category, but the game is between all of the players that are still in the game i.e. the ones that still have cards in their decks, and not only those that had the same category values.

Is should also be noted that an AI player will always select the category that holds the best value on his top most card, and the selection will not be random. That will enhance the realistic feel of the game.

It can also be assumed that after every round the content of the communal deck is being collected by the winner player. This means that for the program, it doesn't matter if the result of a round was a draw or not. If the pile is empty and there is a winner, all players submit their cards in the empty pile and the winner player gets the cards from the round back. If the pile is non empty (i.e. the previous round resulted to a draw), then the winner still gets the current cards and the ones that were previously submitted because of the draw.

Another point that should not surprise a potential gamer, is that, if a player has only one card in hand and wins the current round, then his winning card will still be on top for the next round to come. That happens because the winner collects the cards from the other players and puts them at the back of his deck. Since he, had only one card to play with, this card remains on top by default. Again, that will only happen in the case of one card in hand and a winning result for this card holder.

The online mode assumes that once the player has pressed the button for selecting a category, he cannot change his mind and chose another one. That is, his option has been saved and the only available next step is to show the outcome of the round.

In command line, after the player has selected the category he wants to play with, his choice is only saved after pressing "enter", so he has the chance to change the category before selecting to proceed to the next step.

Another point is, that, as soon as the human player has been eliminated, he has no interest in watching the rest of the game, and therefore, in both modes, there is an option to fast- forward to the end, for which is notified.

Finally, the number of AI players in the online mode is determined by adjusting the JSON file.

3.2 Functionality

The functionality laid out by the program specification was largely the same across both modes – command line and online – with some additional individual functionality required by each.

Game Logic The logic of the Top Trumps game was implemented as specified. A shuffled deck of cards is distributed in turn to each player until all have been given out. One player will be human controlled with up to 4 AI players. Each card has 5 categories each with a positive integer value. The first active player is selected and chooses a category. All the card values are then revealed along with the winner (the holder of the card with the highest value). The winner takes all the cards in play and is the active player for the next turn. In the event of a draw, all the cards are added to a communal pile which will be won by the winner of the next round in addition to the cards in play.

Persistent Game Data Both modes were required to communicate with a database in order to store persistent data about gameplay. The user is provided with the total number of games played, the number of human and AI wins, the average number of draws per game and the longest game played (in number of rounds). This was achieved using PostgreSQL. The database schema (appendix X - schema file) allowed the required information to be saved and provided to the user.

Command Line Mode The command line opens with a menu asking if the user wants to see past statistics from the database or play a new game. Each round of a new game the user is provided with the round number, the active player and the human player's top card. The game logic is then followed and the user is informed who the round winner is before the next round commences. The number of communal cards is given in the event of a draw. If the user is eliminated the game runs to completion automatically. Once the game is completed the user is sent back to the menu and the database is updated with the game statistics.

The command line displays the game information in plaintext and allows the user to enter simple text commands via a numbered interface.

The command line also offers a test log function, whereby the following is logged:

- The contents of the deck when read
- The contents of the deck when shuffled
- The contents of all player decks when dealt
- The contents of the communal pile when altered
- The contents of the players card in play for each round
- The category selected
- The contents of each player's deck at round end
- The winner of the game

This output is saved to a text file.

The command line functionality requirements were met fully as demonstrated in Figure 28, 27 and 41.

Online Mode The online mode hooks into the same game logic as the command line mode through API calls, however calls for different and more complex user interface functionality. The requirements for this interface were:

- A 'menu' page, similar to the command line, where the user selects either 'New Game' or 'View Statistics'
- The user is shown their own top card and allowed to select the category via buttons when it is their turn
- The user is shown who's turn it currently is
- The interface should clearly show every player's cards after a category is selected and highlight the winner
- The user should be informed when the round resulted in a draw
- The user shold be able to see how many cards are left in each player's deck and the communal deck
- The winner should be indicated at the end of the game

The online mode also required that multiple tabs with the game open could be played concurrently. These requirements were fully satisfied by the implementation as shown below: The online mode functionality requirements were met fully as demonstrated in Figure 31, 33, 42 and 38.

3.3 Testing

3.3.1 Command Line Mode

The tests have been derived from the user stories. It is necessary to mention that the presented tests are from the user point of view, while there were numerous tests at the back-end during the development of the program that are not included.

The user persona Bob, wants to play a Top Trumps game in the command line.

User Story	**S0010**
Type of Test	Initiate the game from command line
Used Variable	- "java -jar ITSD2018Project-1.0.jar -c" - "java -jar ITSD2018Project-1.0.jar -c -t"
Result	[Passed] The program returns the main menu to the player, (figure 1 Appendix). As shown above, both game options were used as variables to test the initialisation of the game.
Anti-Variables	- "java -jar ITSD2018Project-1.0.jar -command" - "java -jar ITSD2018Project-1.0.jar -c -o" - "java -jar ITSD2018Project-1.0.jar -n"...
Results	[Exception] The program never initiates the game, if the flag is anything else excepts "-c", "-c -t" or "-o". The program throws an exception in case where the user tries to operate both modes, command line mode and on-line mode. In all other cases the program shows the greeting message and terminates.
Reference	Figure 23 and 24

The user persona Bob can now select one of the three options of the game.

User Story	**S0010**
Type of Test	Select an integer number from the provided options of the main menu.
Used Variables	- integer number, where n=[1,3].
Result	[Passed] The player enter the integer n=1, which initiates a new game. The program returned with a new game.
Anti-Variables	- String - Character - Double or Integer, where n!=[1,3]
Results	[Exception] The program throws an exception when the player does not enter the specified integer between n = [1,2,3]. In case the player enters a different integer, the program throws a message indicating the exact integer variable, where in all other situations the program prints out a message demanding an integer.
Reference	Figure 25 and 26

After the proper response of Bob to the game commands, he excepts from the game to load the cards, shuffle them, and divide to all players as equally as possible.

User Story	**S0020**
Type of Test	Examination of the test log file for the correct loading of deck, correct shuffling and dividing.
Used Variables	No variables for this test.
Result	[Passed] The program does the deck loading, shuffling, creating players' deck and choose randomly the active player correctly.
Anti-Variables	*No anti-variables for this test*
Results	*[No Exception] There is no results for this test.*
Reference	Figure 23 and 43

Bob wants to have a detailed round and understand who is active player, which category is selected and who won the round.

User Story	**S0030** & **S0040**
Type of Test	Game round quality test.
Used Variables	- Press Enter button to show winner
Result	[Passed] The program shows the round number, who is active player, all the cards that participate in this specific round, the selected category inside square brackets and the round winner.
Anti-Variables	*No anti-variables for this quality test*
Results	*[No Exception]* there is no exception for this test, only through the test log file.
reference	Figure 27, 28 and 29

Bob, who is an expert user of command line, wants to have a record of the entire game in details in a test log file. He is able to do so, with the -t flag when he initiate the game

User Story	**S0050**
Type of Test	Run the game with the "-t" flag.
Used Variables	- "java -jar ITSD2018Project-1.0.jar -c -t"
Result	[Passed] The program recognise the -t flag and checks if there is no file as "toptrumps.txt" log file, it creates one, or it rewrites in the existing one.
Anti-Variables	- "java -jar ITSD2018Project-1.0.jar -c -*", where * is anything else than "-t".
Results	*[No Exception]* The program recognise the -c flag but it does not produce or write in the "toptrumps.txt" file.
Reference	Figure 23 and 43

Bob is very cautious about the validity of the game. As a result he wants to examine who won the round and if the AI player selected the highest attribute.

User Story	**S0130**
Type of Test	Print players top cards. Quality test
Used Variables	*No variables used to this test*
Result	[Passed] The program prints out the top cards from all available players. Moreover, the program shows the selected category.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No Exception] There is no exception for this test.*
Reference	Figure 27

Bob is the active player in the game and wants to select a category. The program provides him with the option to enter a integer number that matches a specific category.

User Story	**S0030**
Type of Test	Human Player is active player and selects a category
Used Variables	Integer number n=[1,5]
Result	[Passed] The program receives the input integer variable and makes the desired category active. Then, it returns to the system out the results of the round.
Anti-Variables	String, Characters, Double or Integer variables except n=[1,5].
Results	[Exception] The program throws an exception when the human player did not enter one of the five options. The program catches NULL values, strings, characters, doubles and integer number except the n=[1,5]
Reference	Figure 28 and 29

Bob continues his game and he managed to eliminate some of the players, but he wants to know who has been eliminated.

User Story	**S0040**
Type of Test	Show who players have been eliminated while the human player is in the game. Quality test.
Used Variables	*No variables used for this test.*
Result	[Passed] The program prints out a list with all the active players of the game in each round, right above the players hand.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] There is no exception for this test.*
Reference	Figure 44

Bob has finished his game and wants to see the game statistics.

User Story	**S0180**
Type of Test	Show the game statistics.
Used Variables	*No variables used for this test.*
Result	[Passed] The program prints out a list with all the active players of the game in each round, right above the players hand.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] There is no exception for this test.*
Reference	Figure 41

3.3.2 Online Mode

The user persona Lilly wants to play a game of Top Trumps online.

User Story	**S0200**
Type of Test	Initiate the game from command line to play online.
Used Variables	String - "java -jar ITSD2018Project-1.0.jar -o" & "http://localhost:7777/toptrumps"
Result	[Passed] The first indication of the successful connection to the local server is from the command window. The second indication is by entering the url to the browser.
Anti-Variables	String - "java -jar ITSD2018Project-1.0.jar -*"
Results	[Exception] There is no message of connection with the server in the command window. Also, the browser cannot find the url.
Reference	Figure 30 and 31

Lilly wants to press the statistics button and check the game stats, instead of start a new game.

User Story	**S0190** & **S0210**
Type of Test	Quality test. Check the "View Stats" button from the main menu for online mode.
Used Variables	"View Stats" button press.
Result	[Passed] The program opens the statistics view correctly and shows the game stats after a successful CORS call.
Anti-Variables	*No anti-variables used for this test*
Results	*[No Exception] there is no exception for this test.*
Reference	Figure 42

Lilly has decided to play a new game. The program changes the selection view with the game screen view.

User Story	**S0220**
Type of Test	Quality test. Check the "New Game" button from the main menu for online mode.
Used Variables	"New Game" button press.
Result	[Passed] The program successfully opens the game screen view with a new game initialised. The program shows the player's card, who is active player, the current round and the number of cards in the communal pile.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] there is no exception for this test.*
Reference	Figure 32

Lilly is ready to play and he wants to know what category is selected by the other players.

User Story	**S0220**
Type of Test	Quality test. Check if the game proceeds if the human in not the active player.
Used Variables	"Category Selection" button press.
Result	[Passed] The program process the data and returns the the cards of all players that are still in the game, which category had been selected and who won the round.
Anti-Variables	Check "Categories" are locked.
Results	[Exception] While the human player is not the active player, she cannot select a category.
Reference	Figure 33

Lilly has won a round and wants to select a category from her card.

User Story	**S0220 & S0230**
Type of Test	Press one category button and then the "Select Category" button to proceed.
Used Variables	"Select Category" button press
Result	[Passed] The program store the selected category and waits until the player press the "Select Category" button. After that the round proceed as is, with the calculation of the winner.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] There is no exception for this test.*
Reference	Figure 34 and 35

After several rounds, Lilly has encounter a draw. However, she wants to know how many cards are in the communal pile and that the outcome of the round was a draw.

User Story	**S0240**
Type of Test	Check if the program prints the draw and updates the communal pile.
Used Variables	"Show Winner" press button.
Result	[Passed] the program prints successfully the draw and updates the communal pile with the player cards.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] There is no exception used for this test.*
Reference	Figure 36

Lilly has eliminated from the game and wants to complete this game.

User Story	**S0250**
Type of Test	Use an auto-complete button to complete the game, when the human is eliminated.
Used Variables	"Auto Complete" button press.
Result	[Passed] The program simulates the rest of the game without the human interaction until the winner is decided.
Anti-Variables	*No anti-variables used for this game.*
Results	*[No exception] There is no exception used for this test*
Reference	Figure 37

Lilly has won her game and wants to return to the main menu.

User Story	**S0250**
Type of Test	Check that the program return the screen view to the Main Menu.
Used Variables	There is no button for this test.
Result	[Passed] The program identifies the end of the game and redirect the screen view to the Selection screen.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] There is no exception for this test.*
Reference	Figure 31

Lilly is really up to the game and wants to play simultaneously different games.

User Story	**S0200**
Type of Test	Check that the program can handle multiple games simultaneously.
Used Variables	"http://localhost:7777/toptrumps/" in different tabs.
Result	[Passed] The program can have multiple games at the same time.
Anti-Variables	*No anti-variables used for this test.*
Results	*[No exception] There is no exception for this test.*
Reference	Figure 38

3.4 Deficiencies

The program has been tested thoroughly, during different steps of development, after every sprint in a larger scale, and as a final complete product multiple times. No missing functionality has been observed, and all tests were passed and double- checked as discussed in Section 3.3.

Minor points can be mentioned, but again they are not part of functionality and they do not affect the program in any way. For example, in command line mode, cards are represented graphically as rectangles. If the user tries to reduce the terminal window size below a certain point, the rectangles overlap and do not re-shape automatically to fit the window. It is assumed though, that player would not want to run the game in a very small terminal, so that should not be an issue. Perhaps this would be something to adjust if the period available for the project completion was a little longer. Also these rectangles are drawn using Unicode characters. As such it is recommended that a terminal is used with support for UTF-8 encoding, otherwise the display may not render as intended.

A Minutes of Meeting

A.1 Project Kick-Off

Date	Fri 12-Jan 2018 (Week 1)
Venue	Boyd Orr
MoM Author	Christopher Bellingham
Participants	Ioannis Athanasiadis [IA] Christopher Bellingham [CB] Joseph Doogan [JD] Pavlos Evangelidis [PE] Torquil MacLeod [TM]
Apologies	-

Item	Detail	Resp.	Due
1	Team reviewed and approved Team Organisation Document.	INFO	INFO
2	Publish latest Team Organisation Document to Slack to allow each team member to submit to Moodle.	CB	Fri 12-Jan
3	Create Customer Specification, capturing all requirements. Post-meeting note, see Appendix B.	CB	Sun 14-Jan
4	Populate Trello with User Stories based on Customer Spec prior to Sprint Planning meeting on Wed-17.	ALL	Wed 17-Jan
5	Consider architecture and high-level Object Orientated design prior to Design meeting on Wed-17.	ALL	Wed 17-Jan

A.2 Sprint Planning Meeting

Date	Wed 17-Jan 2018 (Week 2)
Venue	Slack
MoM Author	Christopher Bellingham
Participants	Ioannis Athanasiadis [IA] Christopher Bellingham [CB] Joseph Doogan [JD] Pavlos Evangelidis [PE] Torquil MacLeod [TM]
Apologies	-

Item	Detail	Resp.	Due
1	User stories submitted to Trello (Figure 10) were reviewed. Duplicate stories were eliminated, remaining stories were allocated durations.	INFO	INFO
2	Unique Story IDs were granted to each User Story, in the form SXXXX. This will aid communication as development progresses.	INFO	INFO
3	Team agreed to define each story as a Must Have, since all generated stories are strictly limited to the requirements of the specification. The team reserves the right to de-prioritise individual stories should the workload be considered too high.	INFO	INFO
4	The sum of all story points is 16. Broadly, Team feels development can be split into two main phases - command line mode, and online mode. Resultant stories can be found in Appendix C.1 and Appendix C.2 respectively.	INFO	INFO
5	Command line mode covers stories S0010, S0020, S0030, S0040, S0050, S0130, S0180. This equates to a total of 9 story points.	INFO	INFO
6	Online mode covers stories S0190, S0200, S0210, S0220, S0230, S0240, S0250. This equates to a total of 7 story points.	INFO	INFO

Item	Detail	Resp.	Due
7	Development of command line and online mode will be tackled over the course of two 1-week long sprints. With consideration for the need for sprint planning/retrospectives, this leaves 6 days per sprint. Each team member's capacity was assumed to be one third of this duration, I.e. 2 ideal days each. Considering a team size of 5, total available capacity per sprint is 10 ideal days.	INFO	INFO
8	With consideration of team capacity, it is deemed feasible to tackle the project over the course of two 1-week sprints. Sprint 1 will tackle command line mode. Sprint 2 will tackle online mode.	INFO	INFO
9	With initial consideration to an MVC-style architecture, it was noted that each story may slice through multiple layers of this architecture. Team considers it sensible for individuals to have responsibility over different segments of the system, as such each user story will be split between multiple developers. Allocation of user stories to individuals will therefore be deferred until this afternoon's design meeting, where architecture and class structure will be finalised.	INFO	INFO
10	Project schedule was created, allowing for 6-days float/contingency prior to report submission (Figure 11).	INFO	INFO
11	It was agreed that the requirements presented in Appendix B should be cross-referenced to each user story, to ensure full coverage of requirements. A coverage matrix will be produced by the team to confirm there are no coverage gaps. Post-meeting note, see Figure 12. All highlighted requirements which have no matching story shall be part of developer conversations for each user story to ensure no gaps are left.	ALL	Fri 19-Jan

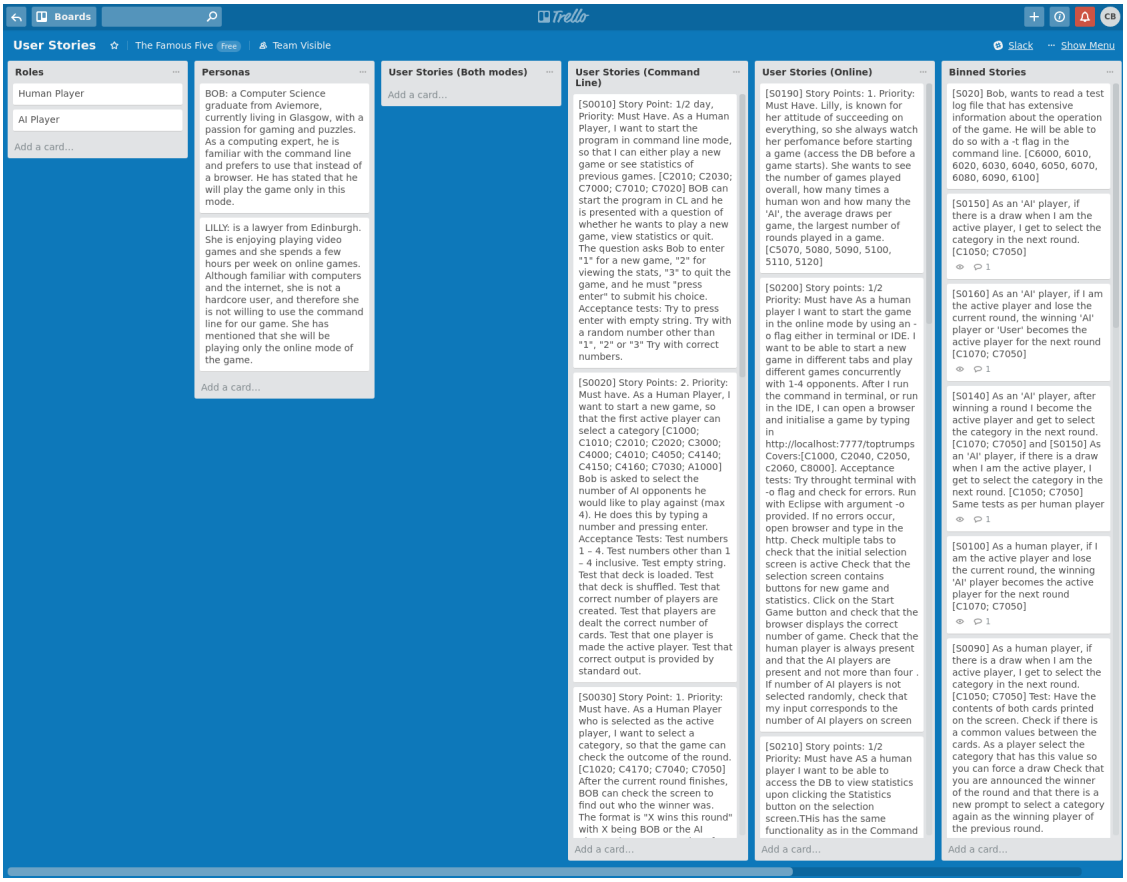
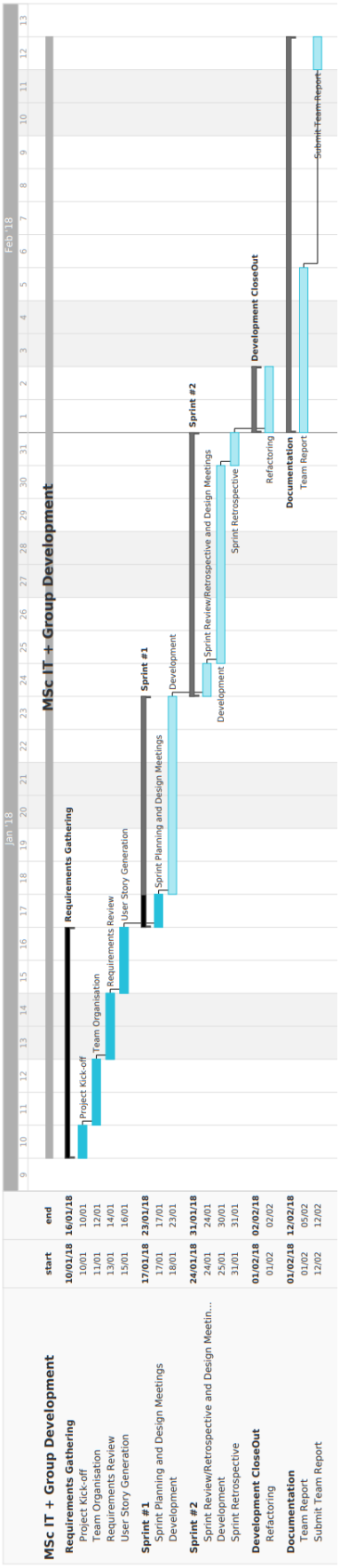


Figure 10: User Stories in Trello.



MSc IT + Group Development	start	end
Requirements Gathering	**10/01/18**	**16/01/18**
Project Kick-off	10/01	10/01
Team Organisation	11/01	12/01
Requirements Review	13/01	14/01
User Story Generation	15/01	16/01
Sprint #1	**17/01/18**	**23/01/18**
Sprint Planning and Design Meetings	17/01	17/01
Development	18/01	23/01
Sprint #2	**24/01/18**	**31/01/18**
Sprint Review/Retrospective and Design Meetin...	24/01	24/01
Development	25/01	30/01
Sprint Retrospective	31/01	31/01
Development CloseOut	**01/02/18**	**02/02/18**
Refactoring	01/02	02/02
Documentation	**01/02/18**	**12/02/18**
Team Report	01/02	05/02
Submit Team Report	12/02	12/02

Figure 11: Initial Project Plan

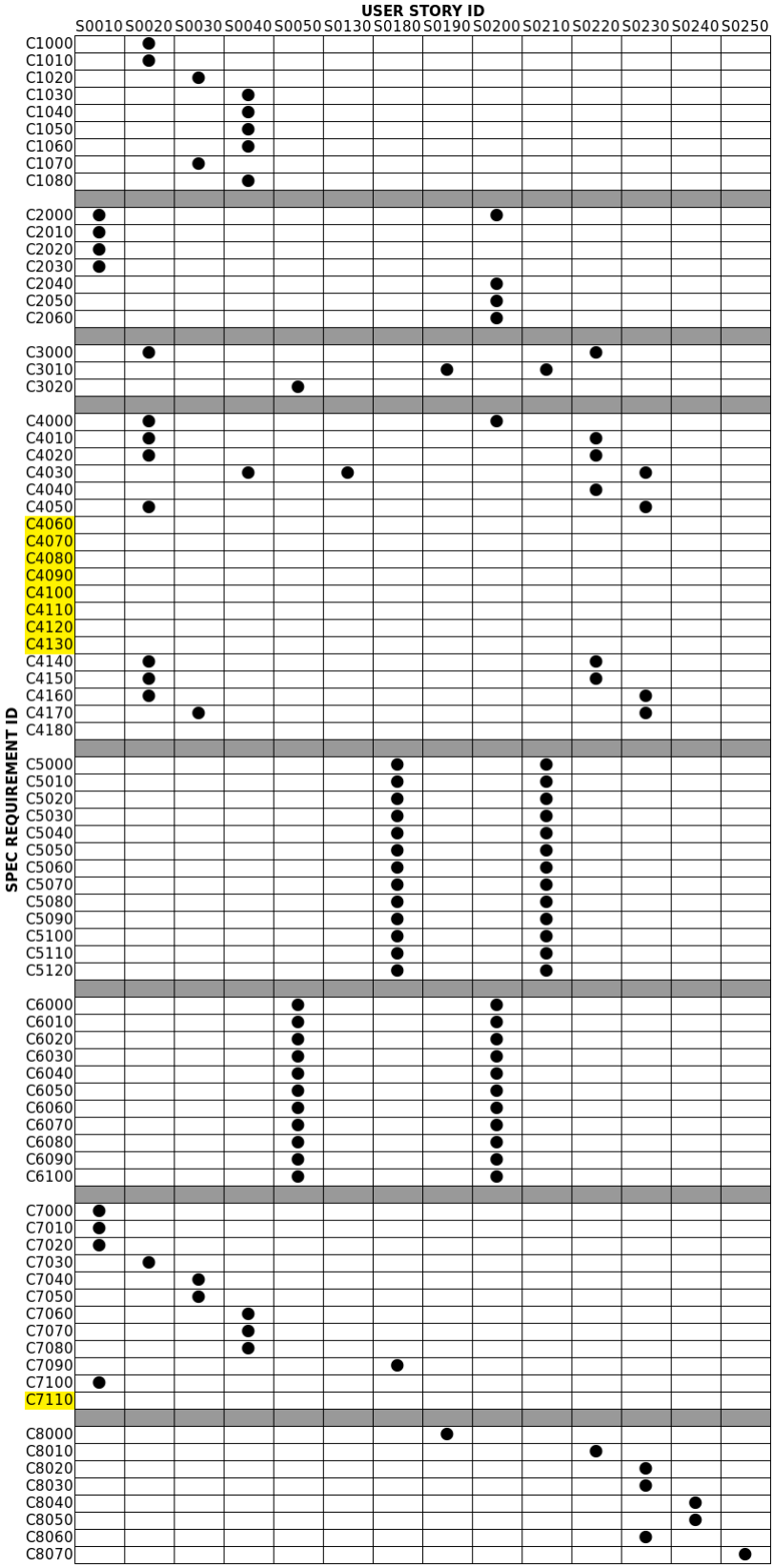


Figure 12: Requirements Coverage Matrix

A.3 System Design Meeting

Date	Wed 17-Jan 2018 (Week 2)
Venue	Slack
MoM Author	Christopher Bellingham
Participants	Ioannis Athanasiadis [IA] Christopher Bellingham [CB] Joseph Doogan [JD] Pavlos Evangelidis [PE] Torquil MacLeod [TM]
Apologies	-

Item	Detail	Resp.	Due
1	CB provided a candidate architecture diagram (Figure 13), outlining use of an MVC architecture, with a data persistence layer. CB proposed use of the Observer Pattern as a means of reducing coupling between MVC layers.	INFO	INFO
2	Use of the Observer Pattern was identified as a risk, since no team member has experience with this. CB will outline how this would work by providing an example of a simple implementation.	CB	Wed 17-Jan
3	Prior to the meeting, each team member had submitted class diagrams to enable discussion on needed class structures. Each submission was reviewed, and it was noted that a lot of commonality exists across proposed classes (typically Game, Player and Card classes).	INFO	INFO
4	CB provided detailed UML covering model and command line mode (Figures 14, 15, 16, 17). JD provided detailed UML covering online mode (Figure 18) It is understood that online mode can hook into key Game functionality via game's available public methods, and online components can be notified of game state changes via the Observer mechanism. The approach as depicted was agreed to be a reasonable solution, and was selected as a basis for overall design.	INFO	INFO
5	CB provided detailed sequence diagram covering logical flow for command line mode (Figure 19). This may be used as a reference during development.	INFO	INFO

Item	Detail	Resp.	Due
6	User stories allocated to team from Appendix C.1 to allow development to commence.	INFO	INFO

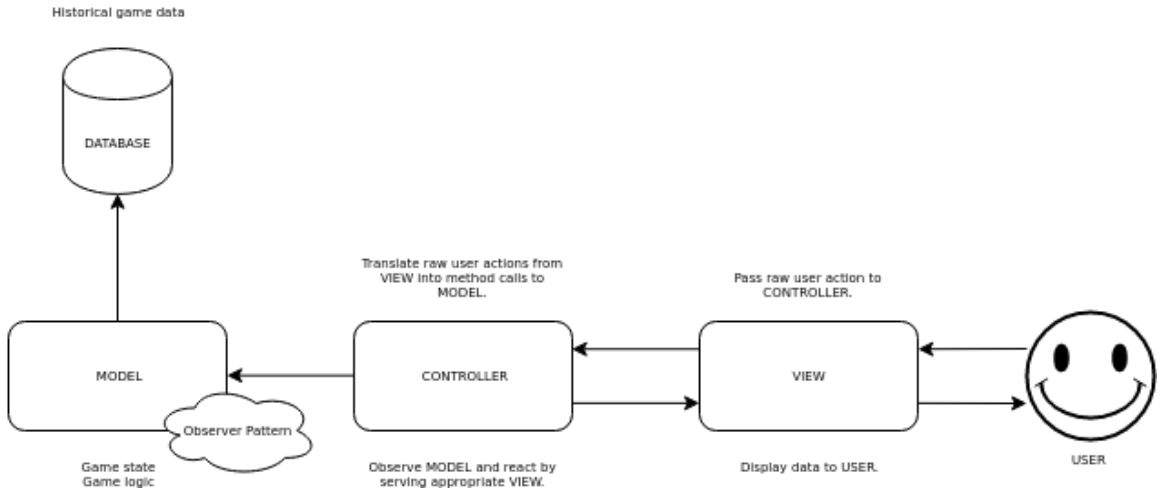


Figure 13: Proposed Architecture

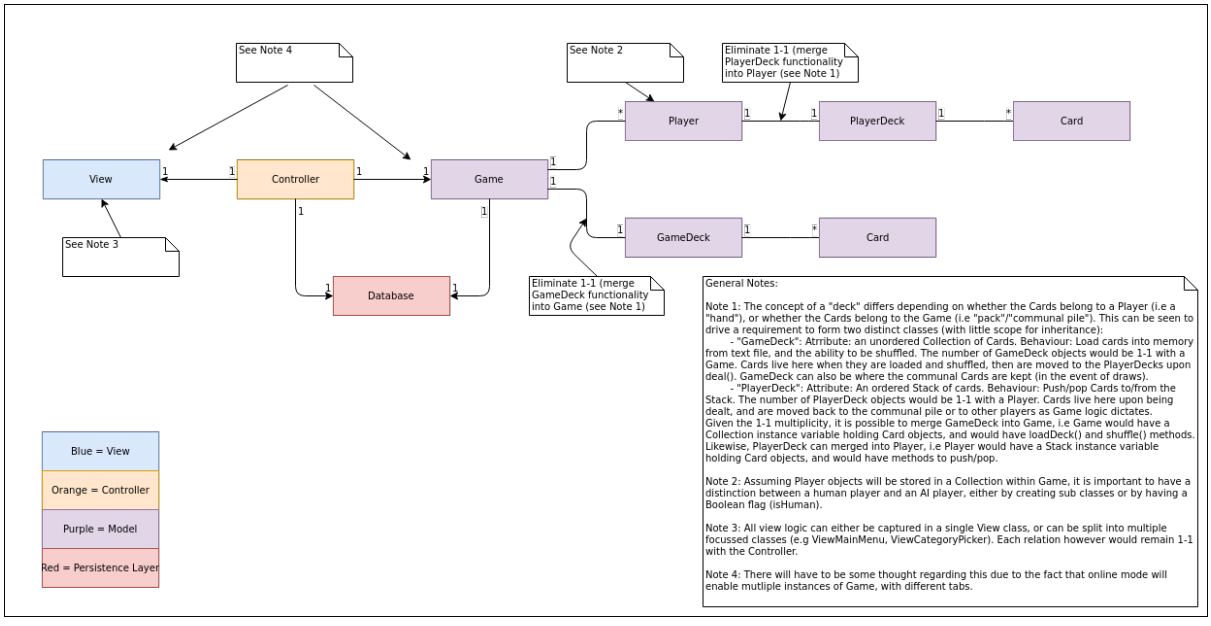


Figure 14: Proposed System UML

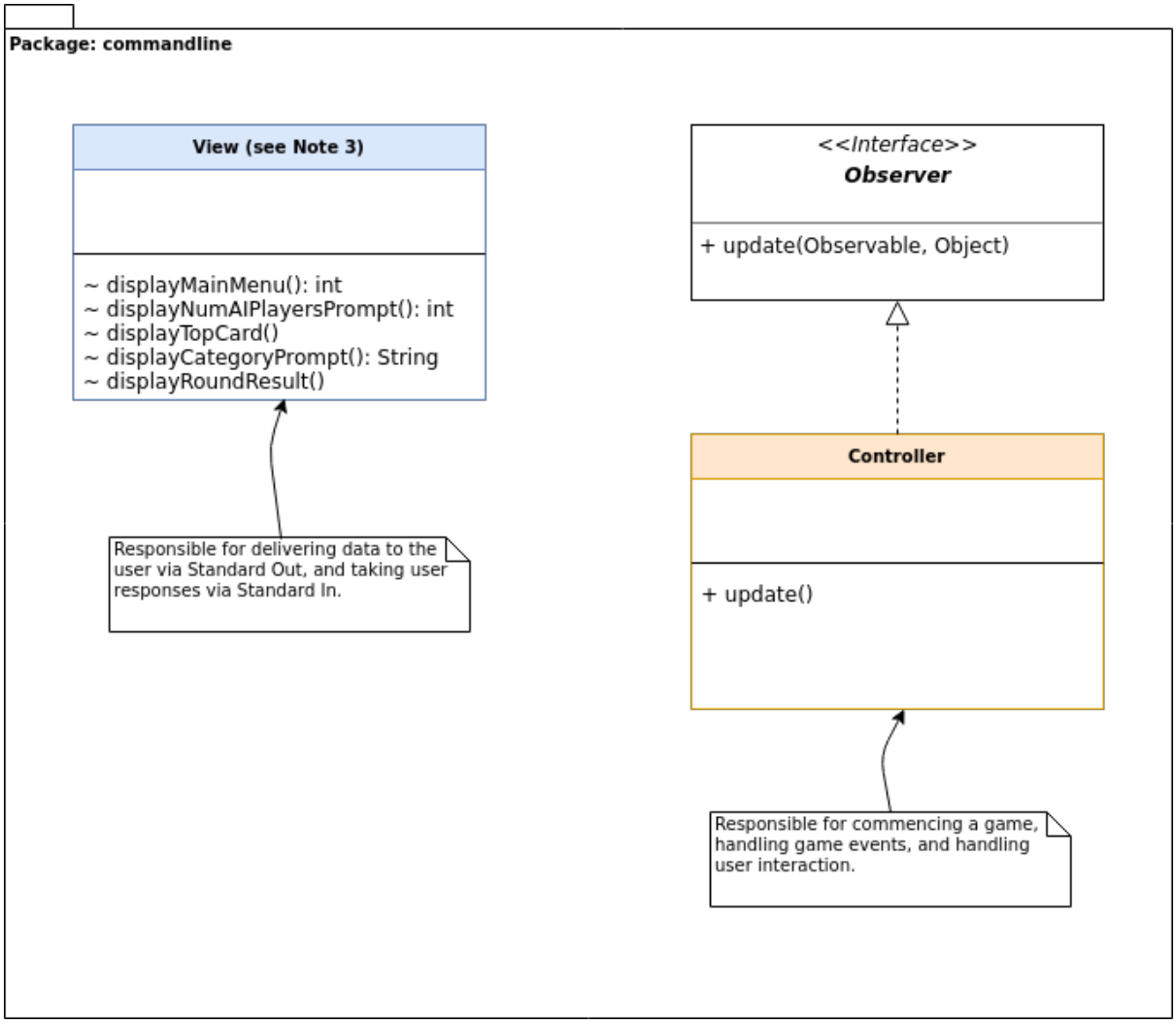


Figure 15: Proposed Command Line Package

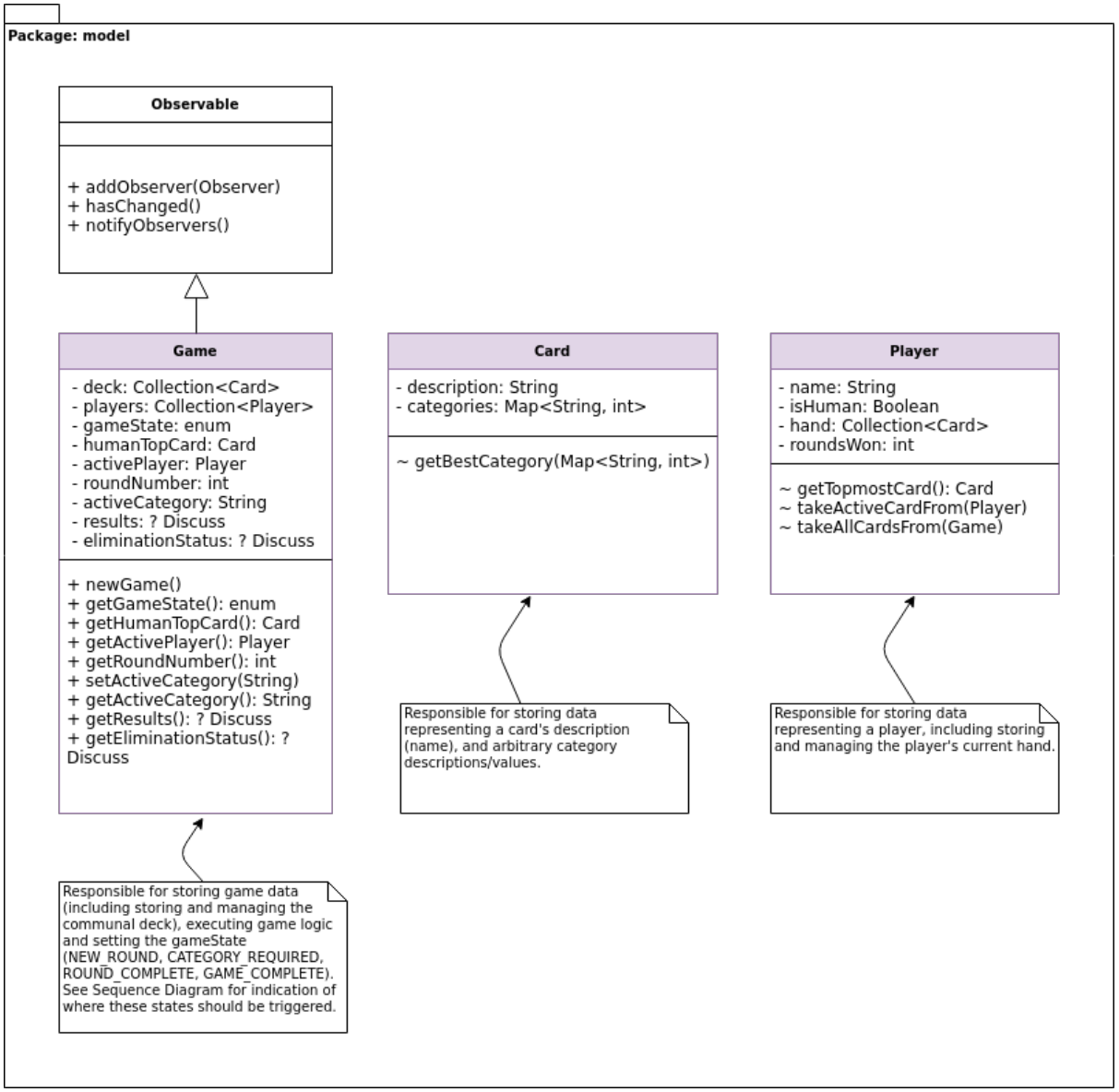


Figure 16: Proposed Model Package

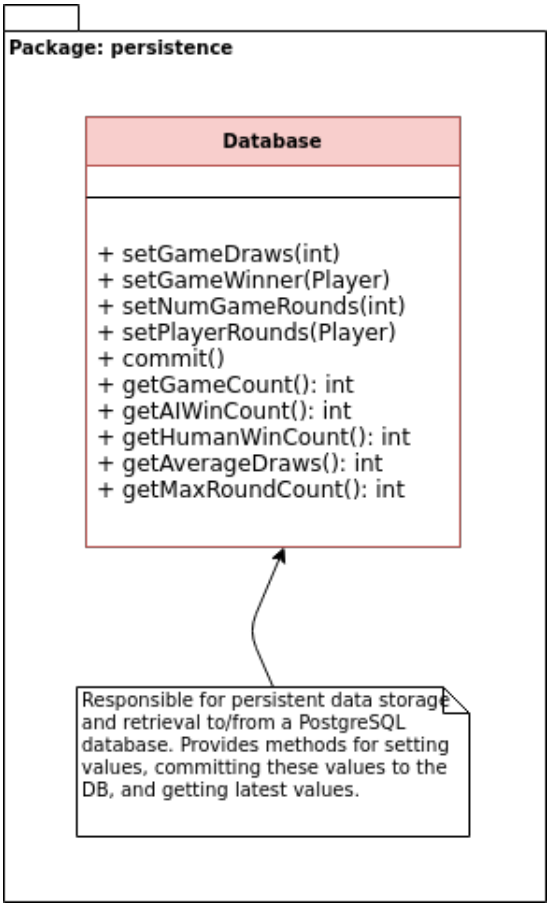


Figure 17: Proposed Persistence Package

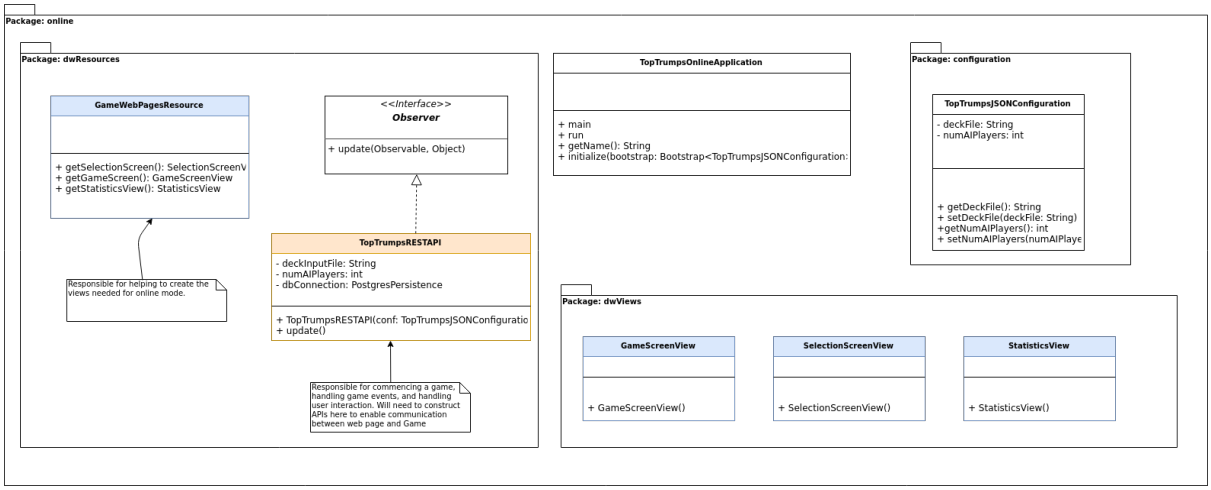


Figure 18: Proposed Online Package

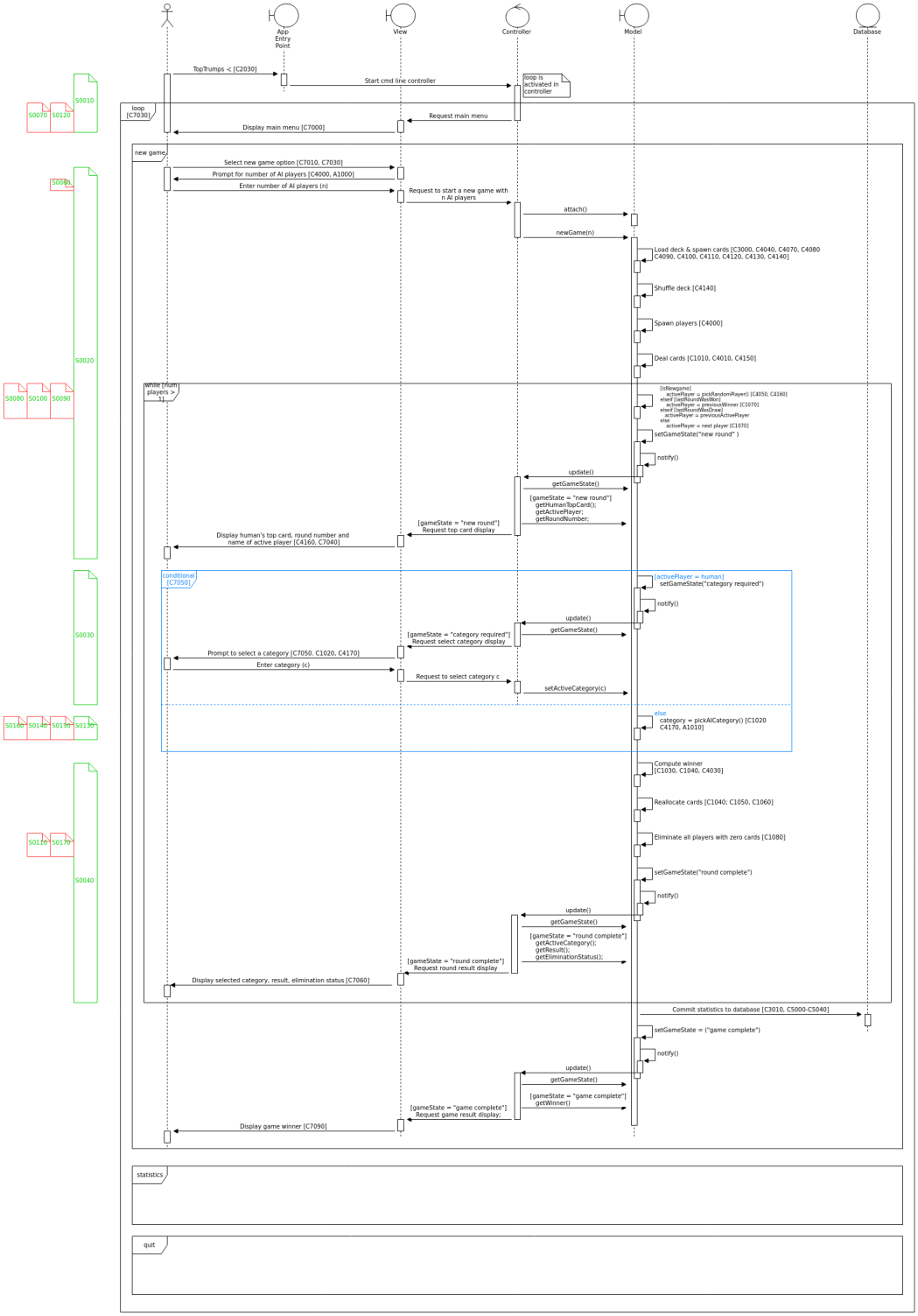


Figure 19: Proposed Logical Flow

A.4 Sprint Review/Planning Meeting

Date	Wed 24-Jan 2018 (Week 3)
Venue	Slack
MoM Author	Christopher Bellingham
Participants	Ioannis Athanasiadis [IA] Christopher Bellingham [CB] Joseph Doogan [JD] Pavlos Evangelidis [PE] Torquil MacLeod [TM]
Apologies	-

Item	Detail	Resp.	Due
1	Sprint #1 user stories were reviewed, and it was determined that all planned stories (see Appendix C.1) were completed.	INFO	INFO
2	It was noted that initial story point estimates for S0030, S0040 and S0130 were insufficient, these took longer than expected. See Appendix C.1 for actual durations. This was due to unexpected underlying complexities, and the need to build-out the initial underlying program structure in order to implement these features.	INFO	INFO
3	Team feels that the workflow, particularly use of Slack to communicate, has been effective. No changes to process are deemed necessary.	INFO	INFO
4	Discussion moved onto Sprint #2, where the stories in Appendix C.2 were reviewed. Ref item [2], to learn lessons from Sprint #1 overrun, the story points allocated to Sprint #2 stories were increased, specifically stories S0200, S0220 and S0230). This is in recognition of technology risk, as no team member has experience with Dropwizard, and only limited experience with HTML/CSS. The assumption remains that the underlying Model logic components developed in Sprint #1 can be re-used however.	INFO	INFO
5	Based on sum of all proposed Sprint #2 stories, velocity for this sprint increases from originally planned 7 to 10. Team feel able to meet the increased workload.	INFO	INFO

Item	Detail	Resp.	Due
6	Project schedule was presented, updated to show latest progress. 6 days still remain for float/contingency prior to report submission (Figure 20).	INFO	INFO
7	User stories allocated to team from Appendix C.2 to allow development to commence.	INFO	INFO

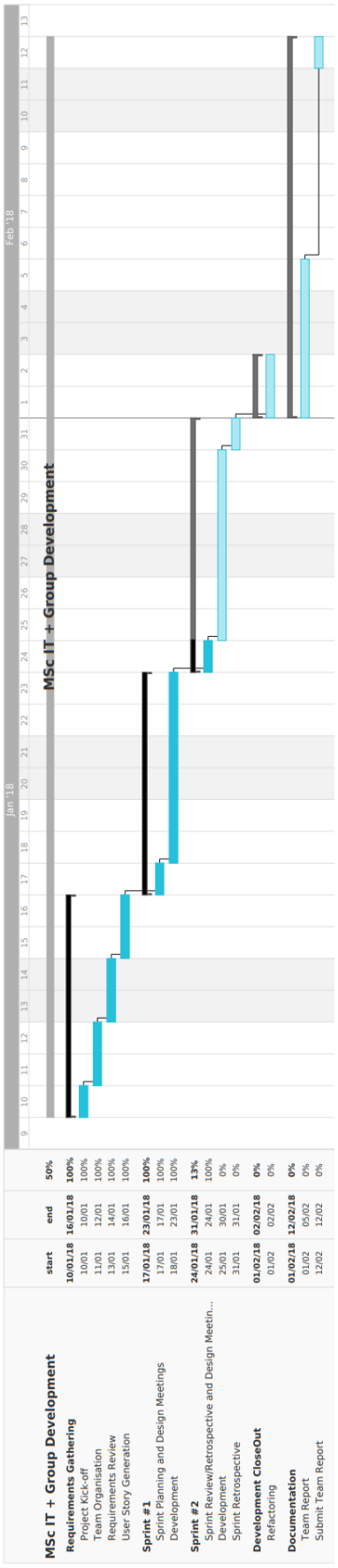


Figure 20: Project Plan prior to Sprint #2.

A.5 Sprint Review/Planning Meeting

Date	Wed 31-Jan 2018 (Week 4)
Venue	Slack
MoM Author	Christopher Bellingham
Participants	Ioannis Athanasiadis [IA] Christopher Bellingham [CB] Joseph Doogan [JD] Pavlos Evangelidis [PE] Torquil MacLeod [TM]
Apologies	-

Item	Detail	Resp.	Due
1	Sprint #2 user stories were reviewed, and it was determined that not all planned stories (see Appendix C.2) were completed. Stories S0220, S0230, S0240 and S0250 remain incomplete.	INFO	INFO
2	Lack of team experience with the online technologies is responsible for the overrun. The asynchronous and stateless nature of the API calls was not considered during design stage. Some additional work is needed to refactor the underlying model to suit the online technologies.	INFO	INFO
3	A third sprint must be scheduled to cover refactoring and to allow completion of stories S0220, S0230, S0240 and S0250.	INFO	INFO
4	A revised project plan is proposed, making use of the available schedule float (Figure 21).	INFO	INFO
5	Durations for user stories S0220, S0230, S0240 and S0250 adjusted to capture required refactoring. See Appendix C.3.	INFO	INFO
6	Based on sum of all proposed Sprint #3 stories, velocity for this sprint is 11. Team feel able to meet the increased workload.	INFO	INFO
7	Duration for team report is extended to account for reduced available resources. Report can be written in parallel with Sprint #3, and extended over the final weekend (Figure 21).	INFO	INFO
8	User stories allocated to team from Appendix C.3 to allow development to commence.	INFO	INFO

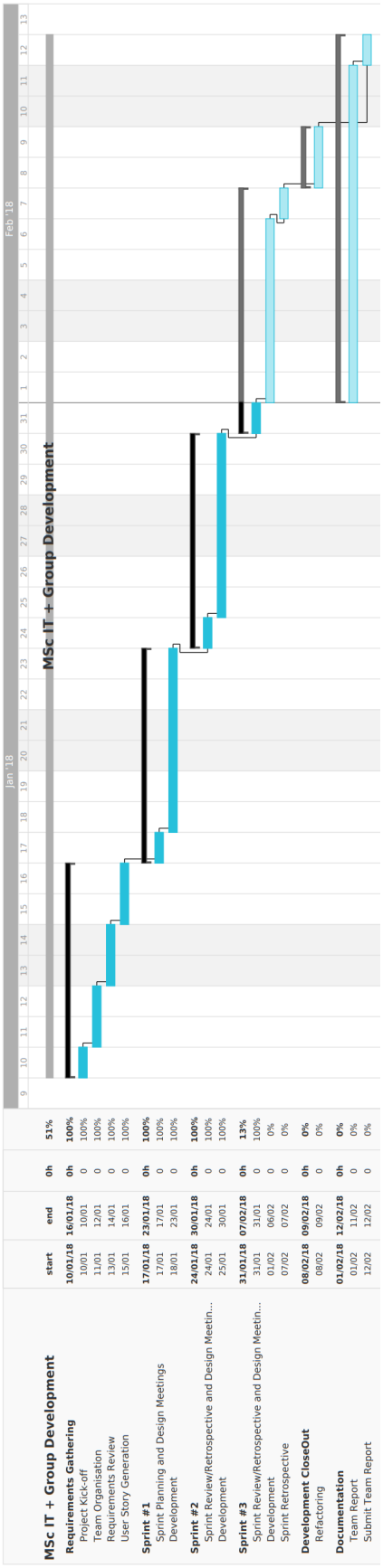
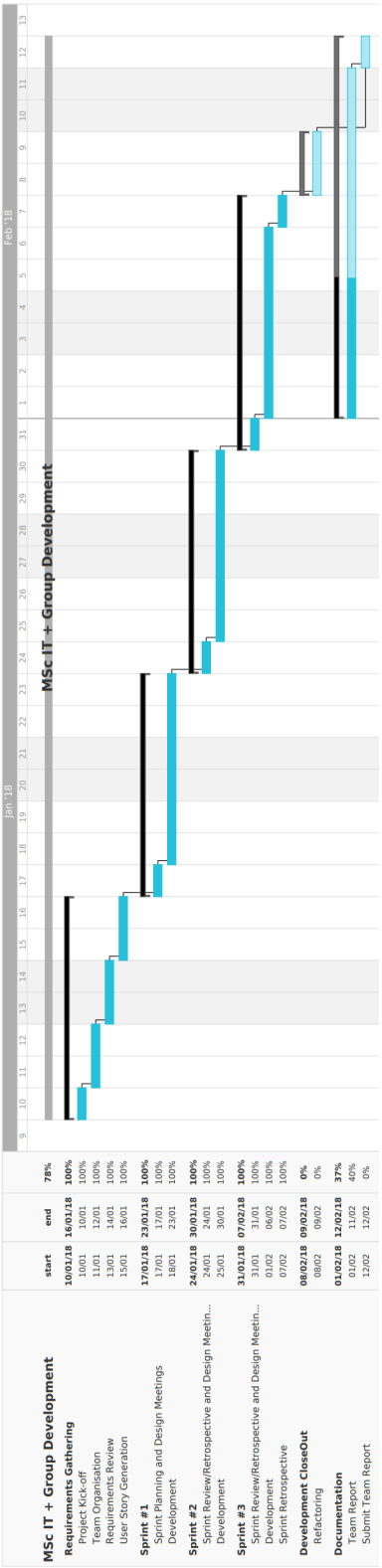


Figure 21: Project Plan prior to Sprint #3.

A.6 Sprint Retrospective

Date	Wed 07-Feb 2018 (Week 5)
Venue	Slack
MoM Author	Christopher Bellingham
Participants	Ioannis Athanasiadis [IA] Christopher Bellingham [CB] Joseph Doogan [JD] Pavlos Evangelidis [PE] Torquil MacLeod [TM]
Apologies	-

Item	Detail	Resp.	Due
1	Sprint #3 user stories were reviewed, and it was determined that all planned stories (see Appendix C.3) were completed.	INFO	INFO
2	All stories were completed in-line with their expected durations. For latest project plan see 22.	INFO	INFO
3	Opportunity will be taken by all team members to review all code and tidy-up prior to submission.	INFO	INFO
4	Final testing will be performed in the Boyd Orr Lab, Thurs 08-Feb, including testing the database functionality on the Yacata server. All team members will present in the Lab to support any issues.	ALL	INFO



MSc IT + Group Development	start	end	78%
Requirements Gathering	**10/01/18**	**16/01/18**	**100%**
Project Kick-off	10/01	10/01	100%
Team Organisation	11/01	12/01	100%
Requirements Review	13/01	14/01	100%
User Story Generation	15/01	16/01	100%
Sprint #1	**17/01/18**	**23/01/18**	**100%**
Sprint Planning and Design Meetings	17/01	17/01	100%
Development	18/01	23/01	100%
Sprint #2	**24/01/18**	**30/01/18**	**100%**
Sprint Review/Retrospective and Design Meetin...	24/01	24/01	100%
Development	25/01	30/01	100%
Sprint #3	**31/01/18**	**07/02/18**	**100%**
Sprint Review/Retrospective and Design Meetin...	31/01	31/01	100%
Development	01/02	06/02	100%
Sprint Retrospective	07/02	07/02	100%
Development CloseOut	**08/02/18**	**09/02/18**	**0%**
Refactoring	08/02	09/02	0%
Documentation	**01/02/18**	**12/02/18**	**37%**
Team Report	01/02	11/02	40%
Submit Team Report	12/02	12/02	0%

Figure 22: Project Plan at Sprint #3 completion.

B Customer Specification

B.1 Purpose

This appendix captures the foundational requirements of the system.

Section B.2 is quoted verbatim from Assignment Specification ITSD2018-TaskDocument. Requirements within are identified in **bold** and given a unique requirement ID, used for cross-referencing with User Stories.

B.2 Customer Specification

B.2.1 Context

Top Trumps is a simple card game in which decks of cards are based on a theme. For example, race cars, dinosaurs, and even TV shows like "The Simpsons". Within a deck each card represents an entity within that topic (e.g. T-Rex for dinosaurs or Bart Simpson for the Simpsons). Within a deck each card has the same list of characteristics. For example, dinosaurs can have a height, weight, length, ferocity, and intelligence. Each card has a value for each characteristic of the deck. The objective of the game is to "trump" your opponent by selecting a category (e.g. intelligence) and having a "better" value for your card than the opponent does in their current card.

Gameplay is as follows:

- [**C1000: There must be at least two players**]. [**C1010: The deck of cards is divided between the players**]. [**C1020: The first player takes their topmost card and selects a characteristic**]. [**C1030: The value of that characteristic is compared against the value for the same characteristic in the other players' top card**]. [**C1040: The player with the best value for that characteristic wins the round and the winner takes all the cards from that round (including their own) and places them at the back of their deck**]. [**C1050: If there is a draw the cards from the round are placed in a new communal pile and a new characteristic is selected by the same player from the next card**]. [**C1060: The winner then takes the cards from the round and any in the communal pile**]. [**C1070: The winner of a round maintains the choice of category until they lose, then the choice moves to the next player**]. [**C1080: Players lose the game when they have no cards left; the player left with all the cards is the winner of the game**].

B.2.2 Aim

The aim is to build a computer program to allow a user to play top trumps against one or more AI opponents given a deck. [**C2000: The program should have two modes**]:

- [**C2010: Command Line Mode: The game is played only through command line input and output**]. [**C2020: In this mode, only one game can be played at a time**]. [**C2030: This mode should be selected via a -c flag when starting the program**]: o java -jar TopTrumps.jar -c
- [**C2040: Online Mode: The game should be hosted as a web service, comprised of a REST API that provides remote access to the core game**

functionality and one or more web-pages that enable a user to play the game]. [**C2050: In this mode, multiple users should be able to play the game concurrently (e.g. in different Web browser tabs)**]. [**C2060: This mode should be selected via a -o flag when starting the program**]: o java -jar TopTrumps.jar -o

B.2.3 Functionality

In both modes, the program needs to:

- [**C3000: Enable a user to play a game of top trumps with a deck that was loaded in when the program started**].
- [**C3010: Store the results of past games played in a database as well as visualize that information to the user on-demand**].

In command line mode only:

- [**C3020: Write a test log to file that contains snapshots of the programs state as it runs**].

We discuss each of these requirements in more detail below:

Playing Top Trumps The program should implement the top trumps game as described in the Context section above. You can make the following assumptions to simplify the implementation. Do not add additional unnecessary functionality. This is gold-plating and will not result in a better grade. If in doubt, consult the course co-ordinator.

- [**C4000: There should be one human player and up to 4 computer players (AIs)**].
- [**C4010: If a deck does not divide equally between the players, then some players may have less cards. For example, if there are 3 players and 40 cards, then two players receive 13 cards and one player receives 14**].
- [**C4020: A deck has 5 criteria and the criteria are always positive integers between 1 and 50 (inclusive)**].
- [**C4030: A higher number is always better for any given characteristic**].
- [**C4040: There are 40 cards in a deck.txt file**].
- [**C4050: The first player should be selected at random**].
- [**C4060: A draw won't continue until the point where there are only cards in the communal pile you do not need to deal with this programmatically, just assume that should this happen you are not expected to deal with it**].

[**C4070: The deck we will be using is stored in a text file called 'StarCitizenDeck.txt'**]. [**C4080: The first line of the text file should contain a list of the categories in the deck, separated by a space**]. [**C4090: All decks should have a 'description' category to label the individual cards**]. [**C4100: A description within a deck can be assumed to be unique and a single word**]. [**C4110: The subsequent lines contain details of one card**]. [**C4120: You can assume the order of the categories from the first line align with 3 the values provided for the cards and that all cards have a value for all categories in a deck**]. [**C4130: You can assume that all categories are single words**].

For example, in a dinosaur deck (numbers bear no resemblance to reality):

```
description height weight length ferocity intelligence
TRex 6 6 12 9 9
Stegosaurus 4 3 8 1 8
Brachiosaurus 12 8 16 2 6
Velociraptor 3 5 5 12 10
Carnotaurus 5 6 7 9 8
Iguanodon 2 2 3 1 9
Megalosaurus 9 9 8 6 9
Oviraptor 8 7 4 3 2
Parasaurolophus 7 7 1 3 4
Ornithomimus 10 9 8 7 5
Protoceratops 9 5 4 7 10
Riojasaurus 6 1 4 7 7
Saurolophus 7 1 10 7 8
Styracosaurus 7 3 4 1 1
Xiaosaurus 10 6 5 7 2
```

and so forth the star citizen-based deck is provided with the Template Package that can be downloaded from Moodle.

[**C4140: The program must first load all card details from the deck and shuffle them (randomly order them)**]. [**C4150: The program should then deal the cards between the players**]. [**C4160: The user should then be shown the detail from their top card (note there is no need to visualise this in a complex manner, the card details can be shown in text) and the first player is randomly selected**]. [**C4170: If the player is an AI player it should select a category for play, if the user is the first player they should be allowed to select a category to play the round**]. [**C4180: The game play should then proceed as detailed in the section Context**].

Persistent Game Data [**C5000: Upon completion of the game, the user should automatically write the following information about the game play to a database**]:

- [**C5010: How many draws were there?**]
- [**C5020: Who won the game?**]
- [**C5030: How many rounds were played in the game?**]

- [**C5040: How many rounds did each player win?**]

You should select one team members database on the yacata server, from the Database Theory and Applications course, to write to. [**C5050: It is important you do not remove the username and password from the final code, as this allows us to test the software**]. You should also provide details of this database (username, database name and password) in the report.

[**C5060: There should also be possible, so long as a game isn't currently in progress, for the user to connect to the database and get information about previous games**]. This should include the following:

- [**C5070: Number of games played overall**].
- [**C5080: How many times the computer has won**].
- [**C5090: How many times the human has won**].
- [**C5100: The average number of draws**].
- [**C5110: The largest number of rounds played in a single game**].
- [**C5120: These values should be calculated using SQL**].

Test Log In addition to the functionality described above, you should implement the following to allow for program debugging when in command line mode only. [**C6000: When the program is started, if a -t flag is set on the command line, then the program should write out an extensive log of its operation to a toptrumps.log file in the same directory as the program is run**], e.g.: java -jar TopTrumps.jar -c -t

[**C6010: If a toptrumps.log file already exists, your program should overwrite that file**]. [**C6020: Your program should print the following information to that file, separated by a line containing dashes at the appropriate times as mentioned below**]:

- [**C6030: The contents of the complete deck once it has been read in and constructed**].
- [**C6040: The contents of the complete deck after it has been shuffled**].
- [**C6050: The contents of the users deck and the computers deck(s) once they have been allocated. Be sure to indicate which the users deck is and which the computers deck(s) is**].
- [**C6060: The contents of the communal pile when cards are added or removed from it**].
- [**C6070: The contents of the current cards in play (the cards from the top of the users deck and the computers deck(s))**].
- [**C6080: The category selected and corresponding values when a user or computer selects a category**].
- [**C6090: The contents of each deck after a round**].
- [**C6100: The winner of the game**].

Command Line Mode [**C7000: When started in command line mode, the program should ask the user whether they want to see the statistics of past games (see the Persistent Game Data section) or whether they want to play a game**]. [**C7010: The users choice should be obtained from standard in (System.in)**]. [**C7020: If they select to see statistics of past games, the program should print the associated statistics to standard out (System.out) and then ask the same question again**]. [**C7030: If they select to play a game, a game instance should be started, and the core game loop initialized**]. [**C7040: For each round, the round number, the name of the active player and the card drawn by the player should be printed to standard out**]. [**C7050: If the user is the active player, then it should ask the player to select a category, and obtain the users choice from standard in, otherwise the AI player should select a category**]. [**C7060: The program should then print to standard out the selected category, who won (or whether it was a draw), the winning card and whether the player has been eliminated (they have no cards left)**]. [**C7070: Rounds should continue to be played until a winner is determined (only one player has cards left)**]. [**C7080: Once the user has been eliminated, the remaining rounds should be completed automatically (without user input)**]. [**C7090: At the end of the game, the overall winner should be printed, and the Persistent Game statistics should be updated**]. [**C7100: The user should then be asked if they want to print the statistics of past games or play another game**]. [**C7110: An example of the command line output for the program is provided in the CLI.example.txt file on Moodle**].

Online Mode Online mode is an extension to the command line mode that provides a version of the game that users can play through their Web browser. A Web application has two main components. First, a back-end Application Programming Interface (API) that provides remote access to the game functionalities (e.g. starting a new game, drawing cards or getting players/cards for display). Second, one or more webpages that use the back-end API to enable the user to play the game. In this case, each web page should be comprised of HTML elements that are displayed and Javascript functions that connect to the API.

The webpage design is down to you, but it should display the following:

- [**C8000: Upon loading the web page, the user should be presented the option to view overall game statistics (as detailed previously), or play a single game**].
- [**C8010: During game play, the GUI should display the contents of the users top card and, when they are the active player, allow the user to select a category to play against the computer**].
- [**C8020: The GUI should clearly indicate whos turn it currently is, and only allow the user to select a category when it is their turn**].
- [**C8030: Once the category has been selected for a round and the values compared, the GUI should display the values of the category for each player and highlight who won the round**].
- [**C8040: If a draw should occur, the user should be notified of this**].

- [**C8050: The GUI should contain an indication of how many cards are in the communal pile**].
- [**C8060: The GUI should contain an indication of how many cards are left in the users deck and in the computers deck(s)**].
- [**C8070: When the round played results in the game finishing, an indication of the overall winner should be presented to the user along with an option to update the database with the statistics of the game as previously described**].

C Final User Stories

C.1 Sprint #1: Command Line Mode

S0010

Must Have Est: 1 Act: 1

As a Human Player, I want to start the program in command line mode, so that I can either play a new game or see statistics of previous games.

S0010

BOB can start the program in CL and he is presented with a question of whether he wants to play a new game, view statistics or quit. The question asks Bob to enter “1” for a new game, “2” for viewing the stats, “3” to quit the game, and he must “press enter” to submit his choice. Acceptance tests: Try to press enter with empty string. Try with a random number other than “1”, “2” or “3” Try with correct numbers.

S0020

Must Have Est: 2 Act: 2

As a Human Player, I want to start a new game, so that the first active player can select a category.

S0020

Test that deck is loaded. Test that deck is shuffled. Test that correct number of players are created. Test that players are dealt the correct number of cards. Test that one player is made the active player. Test that correct output is provided by standard out.

S0030

Must Have Est: 1 Act: 2

As a Human Player who is selected as the active player, I want to select a category, so that the game can check the outcome of the round.

S0030

After the current round finishes, BOB can check the screen to find out who the winner was. The format is "X wins this round" with X being BOB or the AI player. The category values for each player are presented on the screen. Acceptance Tests: Play a round and check that the correct category values are shown for each player. Check that the correct player wins each time. Check that draw takes place if there are multiple highest cards. Check that correct player becomes/remains active player for next round. Check whether there is a message at the end specifying the winner.

S0040

Must Have Est: 1 Act: 2

As a Human Player I want to know the outcome of the round, so that the game can progress to the next round.

S0040

BOB will know if it is his or the opponents round without having to do anything further. Tests: Check that after each round there is an output mentioning the winner. Check that user can continue to progress to new rounds even if eliminated.

S0050

Must Have Est: 1 Act: 1

As a human player I want to choose to record game log information in a file when I start a game in command line mode.

S0050

BOB can navigate to the game folder and see the game log. (Not sure if the user has the option NOT to log the game information) Acceptance Tests: Initiate a game and set -t flag in the CL. After the game finishes check that there exists a log file in the game directory, named topTrumps.log. Write a test log file with known content. RE-run the game and check that the original file is overwritten with the correct content. Check the content of the file as per C6030- C6100 requirements.

S0130

Must Have Est: 1 Act: 2

As a Human Player, when not the active player for a round, I want the active AI player to select a single category which has the highest or joint highest value for their topmost card.

S0130

While developing, have the system.out print all the values for the AI player, i.e. the contents of their top most card. Upon selecting a category, have a system.out for the category selected and the value. Compare with the contents of the whole card to make sure that the highest value category is always selected by the AI player.

S0180

Must Have Est: 2 Act: 2

Bob and Lilly are really into statistics and they want to keep track of the game stats after a game ends. As experienced players they want to know how many draws were in the game, how many rounds were played, how many rounds were won by each player (with clear indication) and who won the game. They don't want to press anything for this procedure, it must be automated.

S0180

Query the Database to make sure everything has been recorded.

C.2 Sprint #2: Online Mode

S0190

Must Have Est: 1 Act: 1

Lilly, is known for her attitude of succeeding on everything, so she always watch her performance before starting a game (access the DB before a game starts). She wants to see the number of games played overall, how many times a human won and how many the “AI”, the average draws per game, the largest number of rounds played in a game.

S0190

Test the ”view stats” button that redirects the screen view to the ”statistics view”. Also, test that the program connects with the database and returns the past results successfully.

S0200

Must Have Est: 1/2 Act: 2

As a Human Player, I want to start the game in the online mode by using an -o flag either in terminal. I want to be able to start a new game in different tabs and play different games concurrently with 1-4 opponents. After I run the command in terminal, I can open a browser and initialise a game by typing in http://localhost:7777/toptrumps.

S0200

Try in terminal with -o flag and check for errors. If no errors occur, open browser and type in the http. Check multiple tabs to check that the initial selection screen is active Check that the selection screen contains buttons for new game and statistics. Click on the Start Game button and check that the browser displays the correct number of game. Check that the human player is always present and that the AI players are present and not more than four. If number of AI players is not selected randomly, check that my input corresponds to the number of AI players on screen.

S0210

Must Have Est: 1 Act: 1

As a Human Player, I want to be able to access the DB to view statistics upon clicking the Statistics button on the selection screen. This has the same functionality as in the Command Line mode as described in [S0180]. The difference is the way I will access this functionality.

S0210

Check that the Statistics button is responsive. Check that all games are stores to the DB, I.e all instances as represented by different tabs.

S0220

Must Have Est: ~~4~~ 2 Act: (incomplete)

As a Human Player, I want to be able to see that the game has actually started, and be guided through the steps of what I need to do next. I want to be able to have access on the game information that allow me to navigate through it, and be presented with my options if I am the active player, or have a visual on the storyline if an AI is the active player.

S0220

After clicking on the new game button check that the screen shows: Confirmation that the game has started, by showing for example “Deck has been shuffled and dealt”. The round number I am currently playing Who the active player is. Check that I have the number of cards I have in hand, either on the card, or somewhere else on screen. My topmost card with the characteristics’ values. A button that allows me to proceed to the next step. That is, to select my category if I am the active player or make the AI plaeyer select his. Check that if I am not the active player I do not have the option to select my category.

S0230

Must Have Est: ~~4~~ 2 Act: (incomplete)

As a Human Player, and after I have selected to proceed with the game after selecting the button as described by S0220, I want to trigger the current round. I want to be able to select my category as an active player, or "notify" the AI player that he needs to do the same, and in the end I would like to know the outcome of the round.

S0230

If I am the active player: Check that the button makes me select a category by poping a drop down menu or similar. Check that selecting my category the game proceeds to next step If I am not the active player. Check that the game continies by having the AI player selecting category. In both cases: After selection, check that I have the option to go to the next step, I.e. show the winner After the category selection, check that all cards with their values are visible on screen and that the winner is mentioned. Check that the same winner has the privilege of selecting the new category Check that the number of available cards in hand have been recalculated.

S0240

Must Have Est: 1 Act: (incomplete)

As a Human Player, I want to have access to the game information if a draw has occurred. That includes to be aware that the outcome was a draw and the size of the communal deck. I want to be able to re-select if I was the winner of the previous round.

S0240

Check that in the case of a draw, the screen shows that clearly. Next check that there is an indication of the number of cards in the communal pile Check that a button is present, allowing me to order the game to proceed to the next round. Check that the round number has increased by 1 after the draw and after I have selected to go on. Check that the category selector from previous round is the current selector. In the first winning case, display the number of cards in communal pile to make sure it is reset.

S0250

Must Have Est: 1 Act: (incomplete)

As a Human Player, I want to know who the overall winner was.

S0250

Check that when the last round is finished, the name of the winner is shown. Make sure there is an option to return me to the selection menu, from where I can access the DB or play new game.

C.3 Sprint #3: Online Mode (Additional)

S0220

Must Have Est: 4 Act: 4

As a Human Player, I want to be able to see that the game has actually started, and be guided through the steps of what I need to do next. I want to be able to have access on the game information that allow me to navigate through it, and be presented with my options if I am the active player, or have a visual on the storyline if an AI is the active player.

S0220

After clicking on the new game button check that the screen shows: Confirmation that the game has started, by showing for example “Deck has been shuffled and dealt”. The round number I am currently playing Who the active player is. Check that I have the number of cards I have in hand, either on the card, or somewhere else on screen. My topmost card with the characteristics’ values. A button that allows me to proceed to the next step. That is, to select my category if I am the active player or make the AI plaeyer select his. Check that if I am not the active player I do not have the option to select my category.

S0230

Must Have Est: 4 Act: 4

As a Human Player, and after I have selected to proceed with the game after selecting the button as described by S0220, I want to trigger the current round. I want to be able to select my category as an active player, or "notify" the AI player that he needs to do the same, and in the end I would like to know the outcome of the round.

S0230

If I am the active player: Check that the button makes me select a category by poping a drop down menu or similar. Check that selecting my category the game proceeds to next step If I am not the active player. Check that the game continies by having the AI player selecting category. In both cases: After selection, check that I have the option to go to the next step, I.e. show the winner After the category selection, check that all cards with their values are visible on screen and that the winner is mentioned. Check that the same winner has the privilege of selecting the new category Check that the number of available cards in hand have been recalculated.

S0240

Must Have Est: 2 Act: 2

As a Human Player, I want to have access to the game information if a draw has occurred. That includes to be aware that the outcome was a draw and the size of the communal deck. I want to be able to re-select if I was the winner of the previous round.

S0240

Check that in the case of a draw, the screen shows that clearly. Next check that there is an indication of the number of cards in the communal pile Check that a button is present, allowing me to order the game to proceed to the next round. Check that the round number has increased by 1 after the draw and after I have selected to go on. Check that the category selector from previous round is the current selector. In the first winning case, display the number of cards in communal pile to make sure it is reset.

S0250

Must Have Est: 1 Act: 1

As a Human Player, I want to know who the overall winner was.

S0250

Check that when the last round is finished, the name of the winner is shown. Make sure there is a button to return me to the selection screen, from where I can access the DB or play new game.

D Screenshots

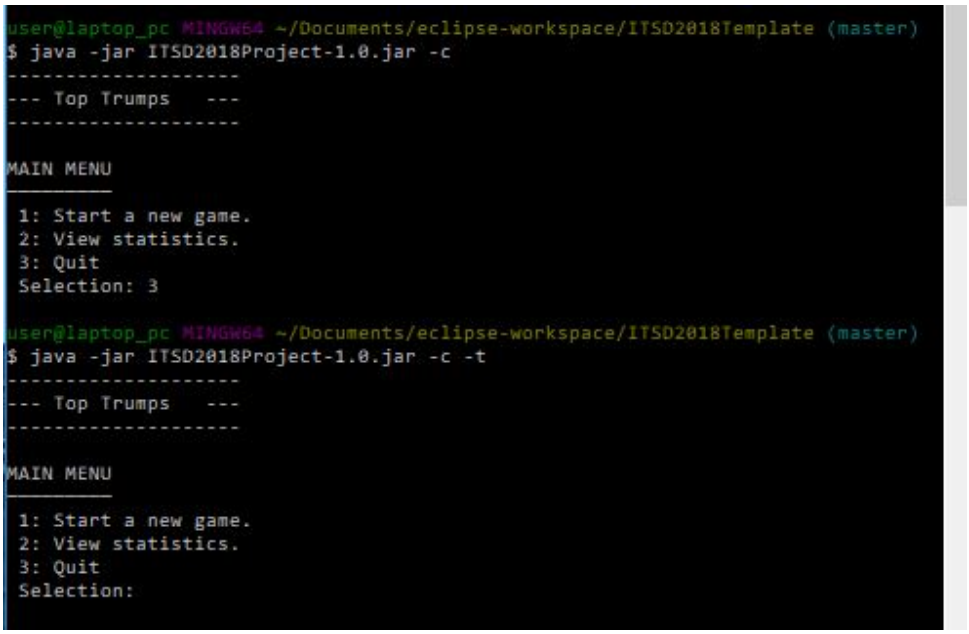


Figure 23: Game Initialisation.

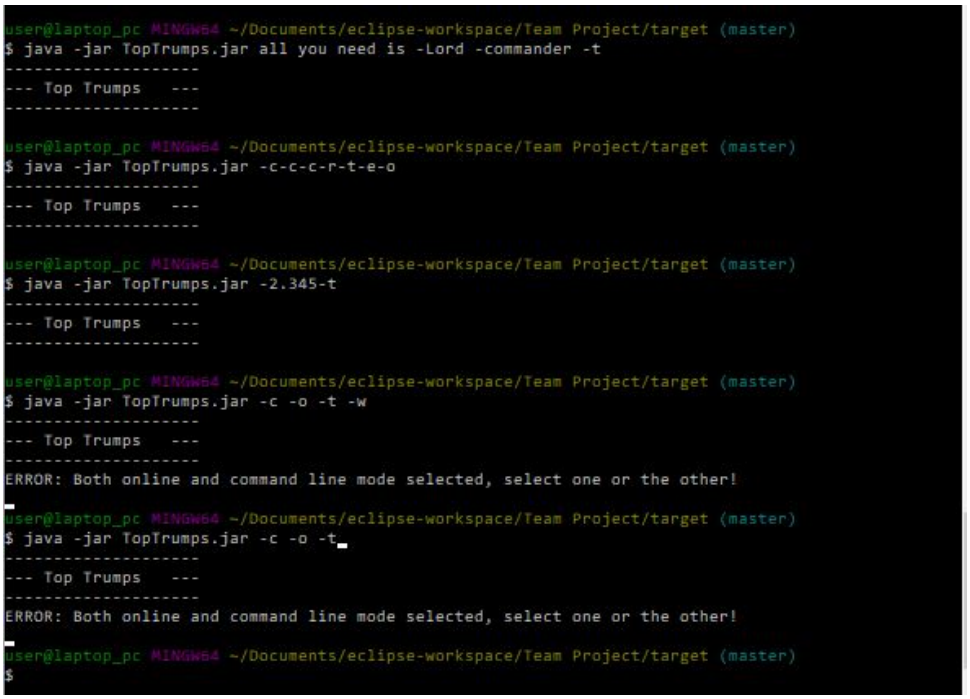


Figure 24: Game Initialisation with wrong flag.

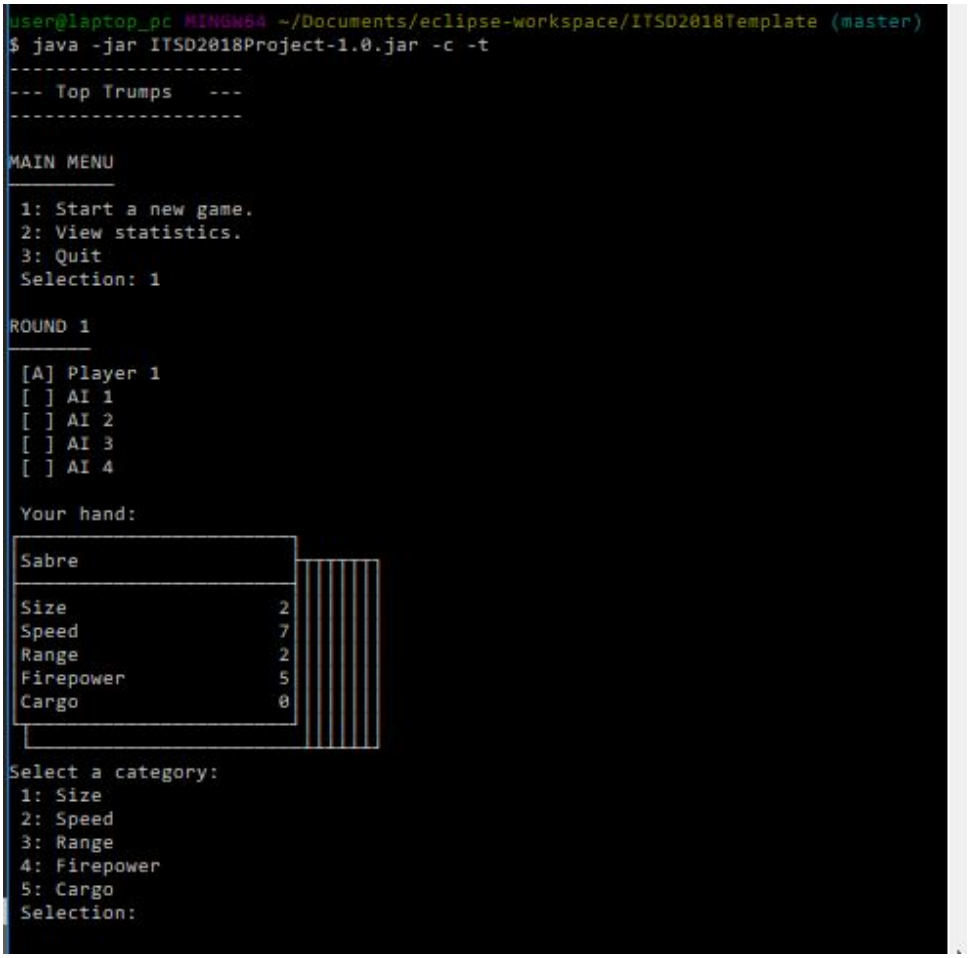


Figure 25: Main Menu with correct integer.

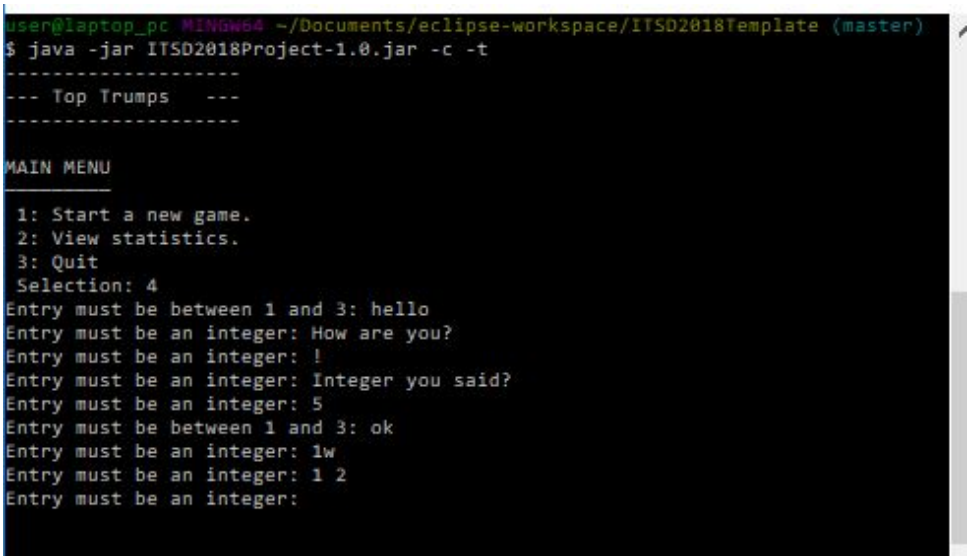


Figure 26: Main Menu with incorrect integer.

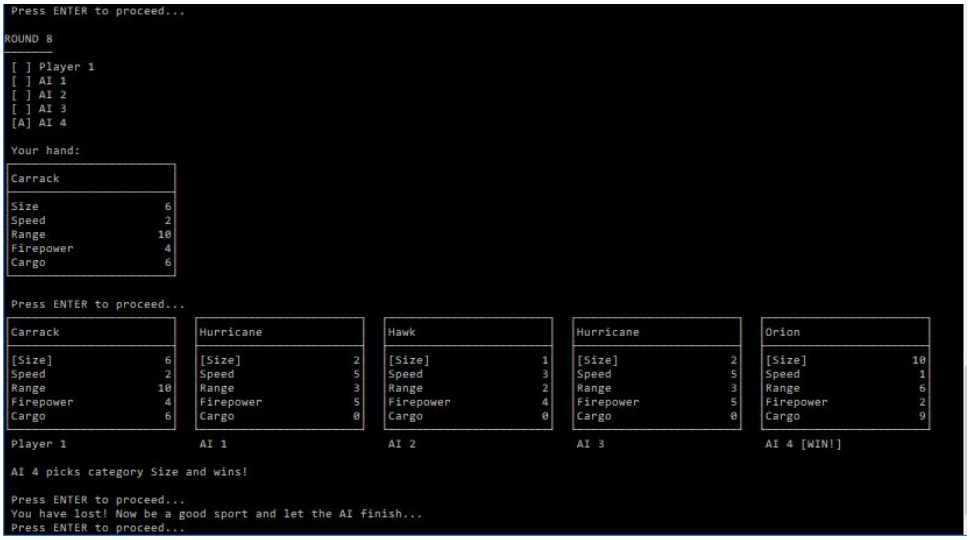


Figure 27: Round information and human player is eliminated.

Figure 28: Human player is active player and has to select a category.

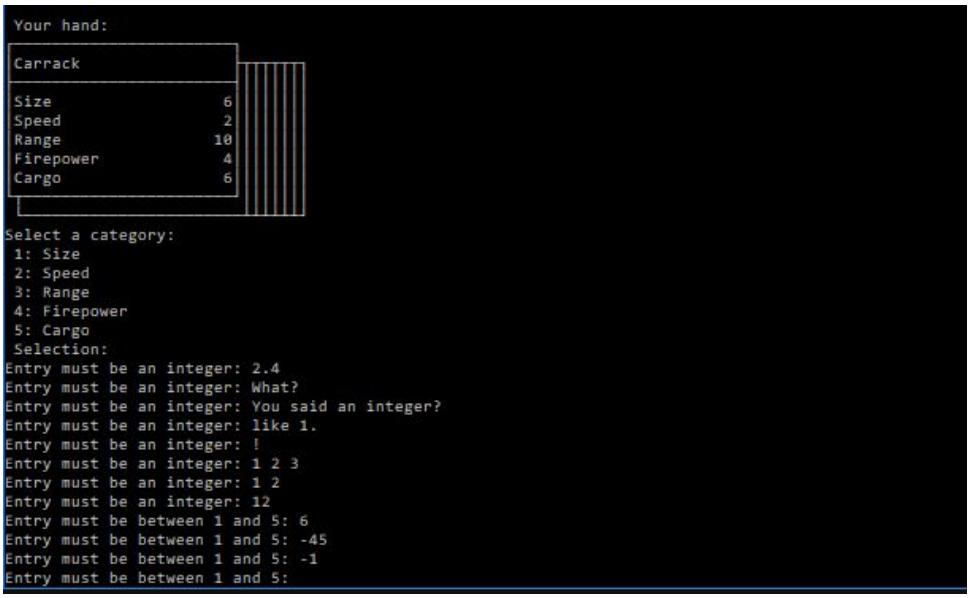


Figure 29: Human player is active player and enters wrong integer number.

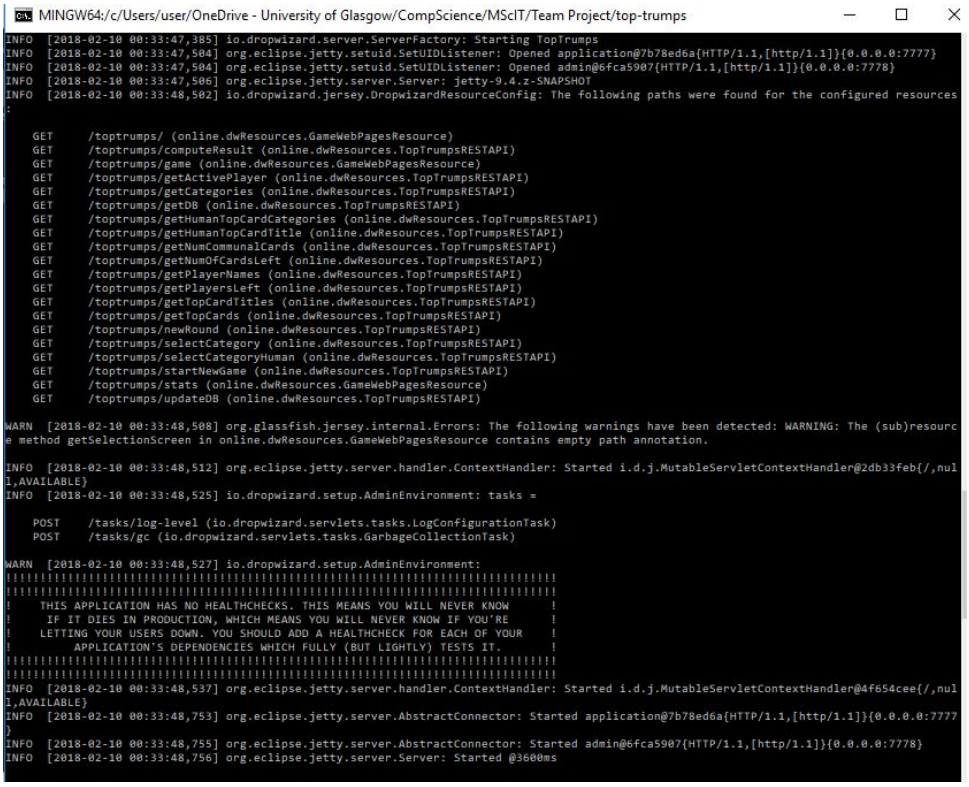


Figure 30: Initialise online game mode.

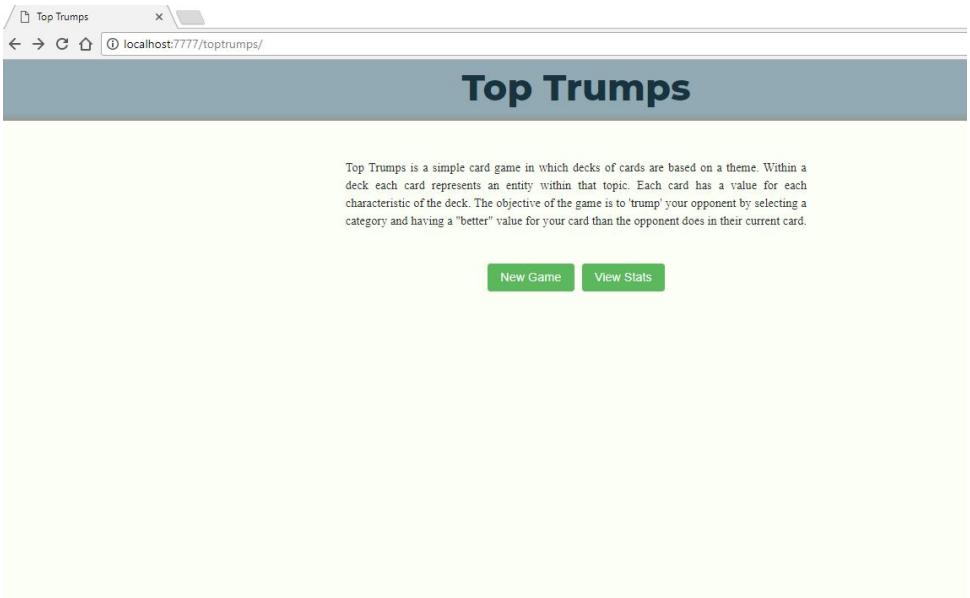


Figure 31: Main menu of the online mode.

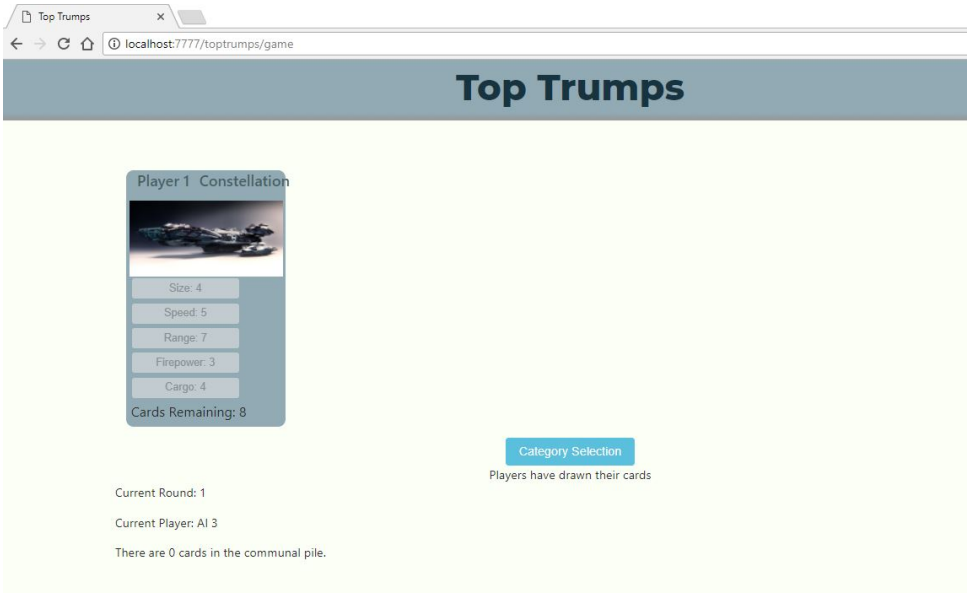


Figure 32: Initialised game, ready to start.

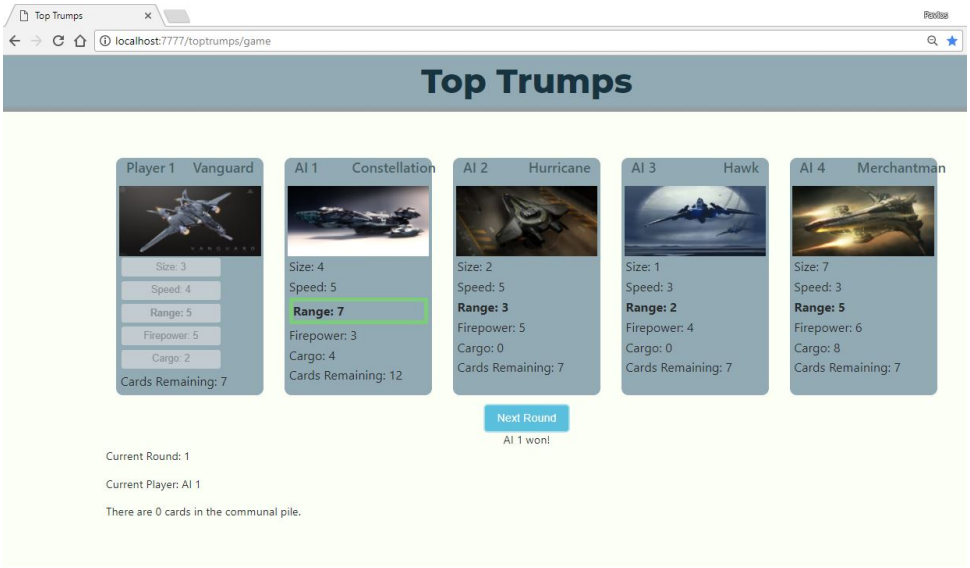


Figure 33: Round winner. With bold is the selected category and with the green rectangular indicates the winner

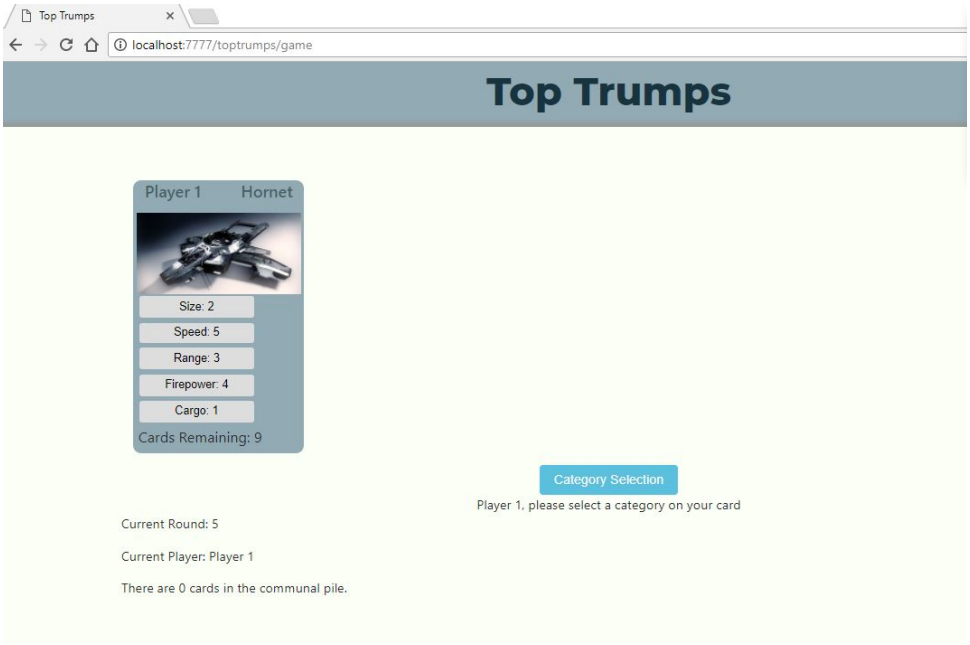


Figure 34: Round winner is the human player and must select a category before the game proceeds.

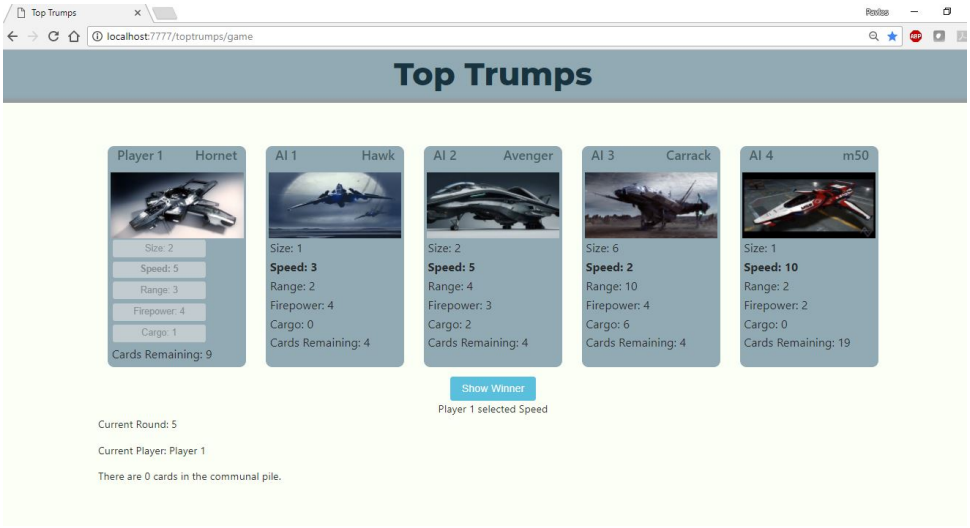


Figure 35: Below the main button displays the selected category and who was active player.

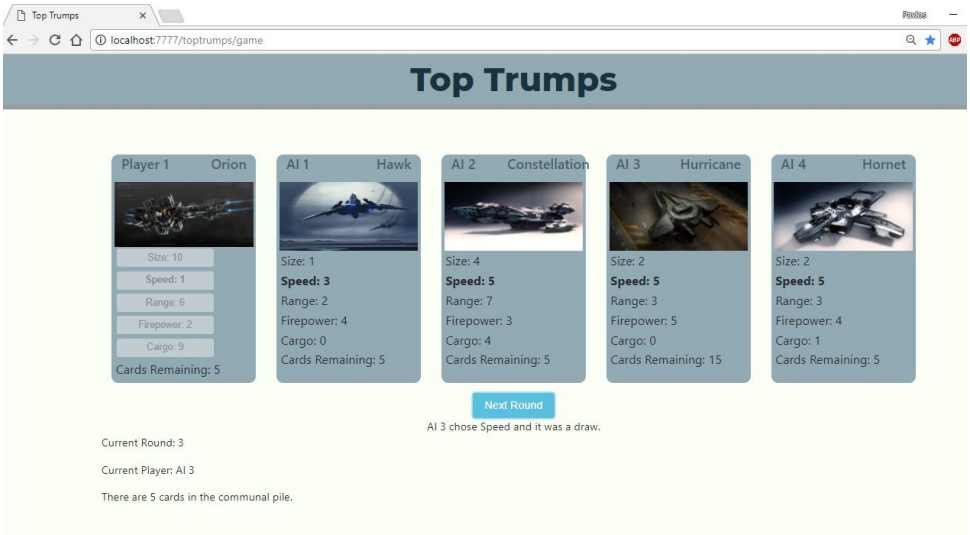


Figure 36: Draw outcome. With bold is the selected category, there is no green indication of winner and the communal pile stores the cards of the players who are still in the game.

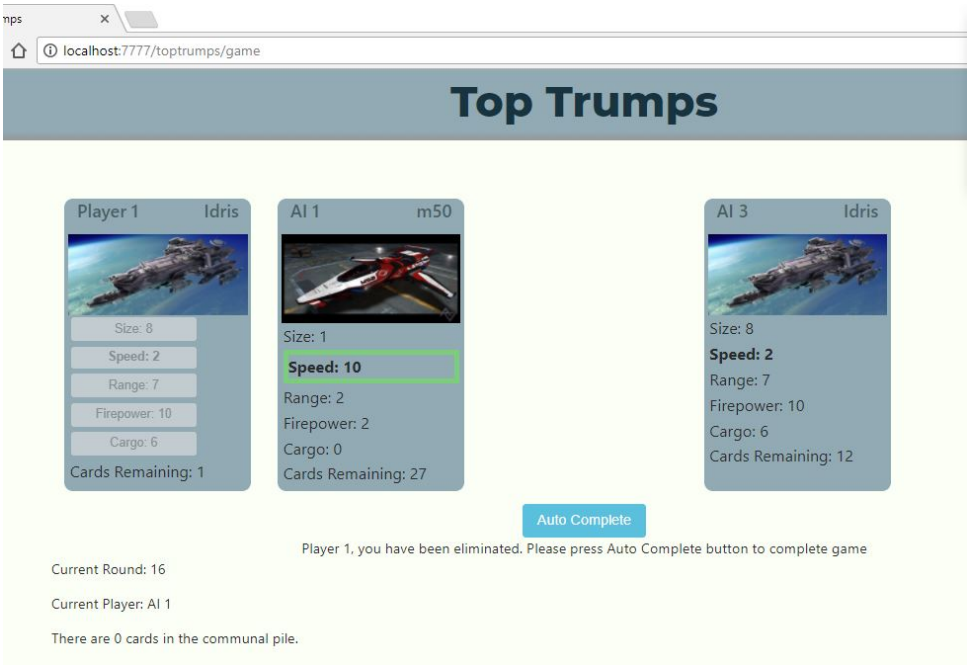


Figure 37: If the human player is eliminated the auto-complete button appears.

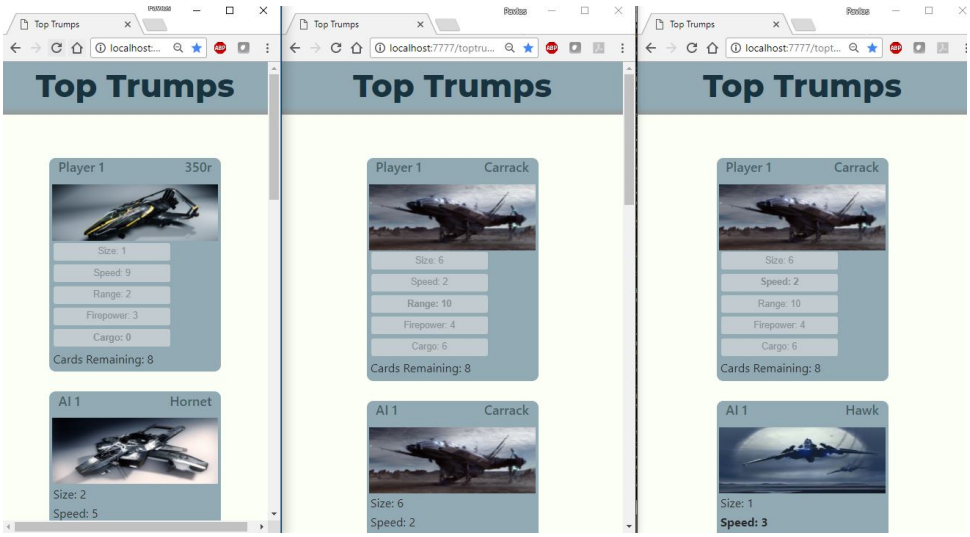


Figure 38: Multiple games can exist simultaneously in different tabs with game index.

```
<!----------------Testing------------------------->
    <nav>
        <ul><li><p id="gameIndex"></p></li>
            <li><p id="playerNames"></p></li>
            <li><p id="p1_wins"></p></li>
            <li><p id="ai1_wins"></p></li>
            <li><p id="ai2_wins"></p></li>
            <li><p id="ai3_wins"></p></li>
            <li><p id="ai4_wins"></p></li>
            <li><p id="ai5_wins"></p></li>
            <li><p id="num_draws"></p></li>
            <li><p id="db_message"></p></li>
        </ul>
    </nav>
<!----------------------------------------------------->
```

Figure 39: The above variables were not hidden during the development of the, in order to test the functionality of the online mode.

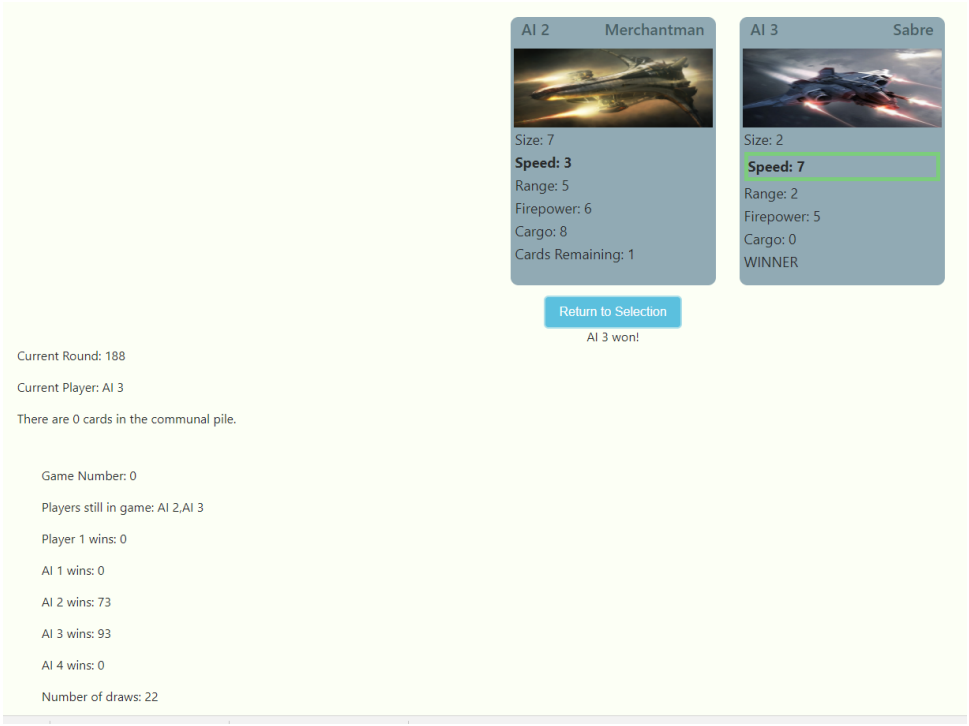


Figure 40: This figure is connected with the figure above and provides a clear understanding about the testing.

```
--------------------
--- Top Trumps   ---
--------------------

MAIN MENU
---------
 1: Start a new game.
 2: View statistics.
 3: Quit
 Selection: 2

STATISTICS
----------
 Games played overall:          14
 AI Wins:                       14
 Human Wins:                    0
 Average draws:                 22.14
 Max rounds in one game:        200
```

Figure 41: Command Line Statistics View

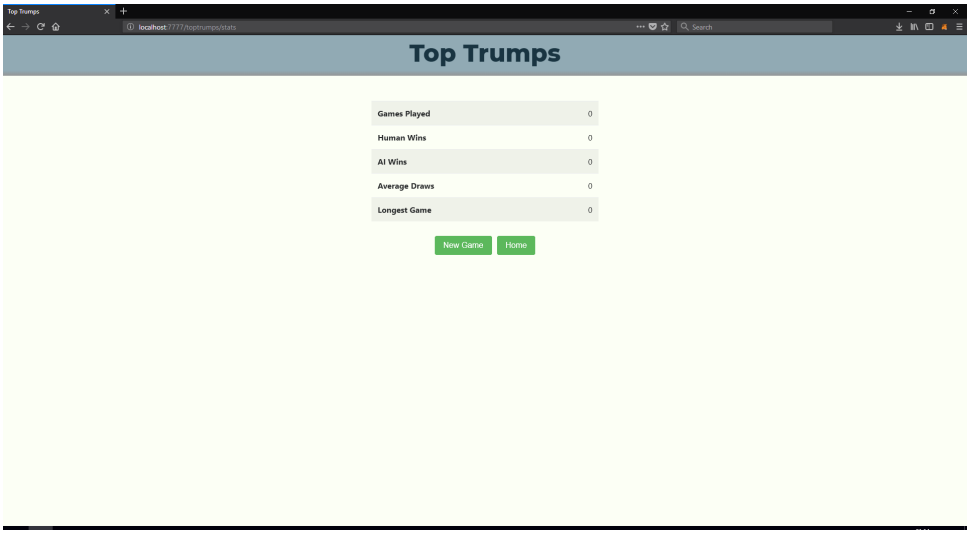


Figure 42: Online Statistics View

toptrumps.log

```
New game starting.
----------------------------------------
Deck loaded: [(Description=350r, Size=1, Speed=9, Range=2, Firepower=3, Cargo=0), (Description
----------------------------------------
Deck shuffled: [(Description=Sabre, Size=2, Speed=7, Range=2, Firepower=5, Cargo=0), (Descript
----------------------------------------
Hand: (Player=Player 1, (Description=Sabre, Size=2, Speed=7, Range=2, Firepower=5, Cargo=0),
Hand: (Player=AI 1, (Description=350r, Size=1, Speed=9, Range=2, Firepower=3, Cargo=0), (Descr
Hand: (Player=AI 2, (Description=Constellation, Size=4, Speed=5, Range=7, Firepower=3, Cargo=
Hand: (Player=AI 3, (Description=Hurricane, Size=2, Speed=5, Range=3, Firepower=5, Cargo=0),
Hand: (Player=AI 4, (Description=Hornet, Size=2, Speed=5, Range=3, Firepower=4, Cargo=1), (Des
----------------------------------------

Round 1 starting.
Active player: AI 1
Player 1's card: (Description=Sabre, Size=2, Speed=7, Range=2, Firepower=5, Cargo=0)
AI 1's card: (Description=350r, Size=1, Speed=9, Range=2, Firepower=3, Cargo=0)
AI 2's card: (Description=Constellation, Size=4, Speed=5, Range=7, Firepower=3, Cargo=4)
AI 3's card: (Description=Hurricane, Size=2, Speed=5, Range=3, Firepower=5, Cargo=0)
AI 4's card: (Description=Hornet, Size=2, Speed=5, Range=3, Firepower=4, Cargo=1)
Selected category: Speed=9
----------------------------------------
Round winner: AI 1
----------------------------------------
Communal Deck: []
----------------------------------------
Hand: (Player=Player 1, (Description=Avenger, Size=2, Speed=5, Range=4, Firepower=3, Cargo=2),
Hand: (Player=AI 1, (Description=Hawk, Size=1, Speed=3, Range=2, Firepower=4, Cargo=0), (Descr
Hand: (Player=AI 2, (Description=Hornet, Size=2, Speed=5, Range=3, Firepower=4, Cargo=1), (Des
Hand: (Player=AI 3, (Description=Idris, Size=8, Speed=2, Range=7, Firepower=10, Cargo=6), (Des
Hand: (Player=AI 4, (Description=Hawk, Size=1, Speed=3, Range=2, Firepower=4, Cargo=0), (Descr
Round complete.
----------------------------------------
```

Figure 43: All the details of the game is inside the test log file.

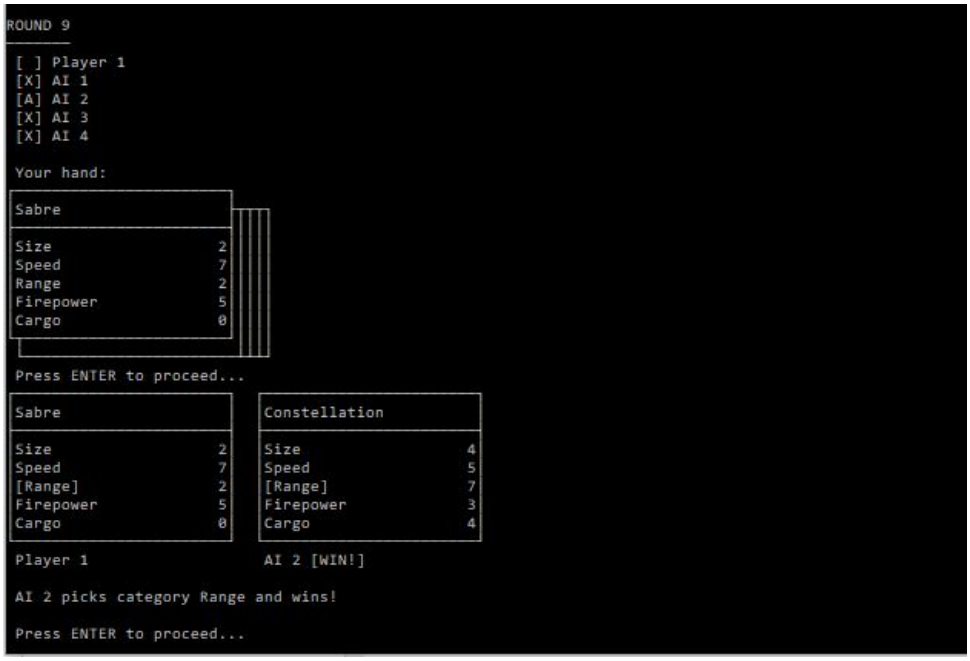


Figure 44: The program shows who is eliminated from the game with a X mark inside the brackets.