Software Requirements Specification for SFWRENG 4G06:
Dice Duels: Duel of the Eights

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1 Reference Material

This section records information for easy reference.

This section has remained blank due to the simplistic nature of our problem space. No unit symbols are used in our document and anywhere a unit is used, it is stated. Additionally all abbreviations and acronyms are explained where they first appear in the document and are from there on out self-explanatory and contextually understandable. There are also no mathematical formulas or mathematical notation within our software requirements specification document. This document was compiled for the SFWRENG 4G06 course, the software engineering capstone course at McMaster University.

2 Specific System Description

This section presents the problem description, which gives a high-level view of the problem to be solved. This is followed by the solution characteristics specification, which presents the assumptions, theories, definitions and finally the instance models.

2.1 Problem Description

Games are a staple of entertainment and are used to bring people together for both competition and fun. There can often be a desire to share the experience of playing a game with someone but meeting can be hard or impossible in-person and so having an online version of popular games allows for such opportunities. One such game is the game of Yahtzee, which while it does have online versions, are limited to the classic rule-set and do not allow for variants to be designed and played. *Dice Duels: Duel of the Eights* looks to solve the issue of not having online access to Yahtzee and the ability to create custom versions of the game and play them.

2.1.1 Terminology and Definitions

This subsection provides a list of terms that are used in the subsequent sections and their meaning, with the purpose of reducing ambiguity and making it easier to correctly understand the requirements:

- Dice rolls can be given in the form AdX where A and X are variables representing the number of dice and number of sides, respectively. When A is 1, its inclusion is optional. For example 4d6 represents rolling 4 6-sided dice, and a d12 represent 1 die with 12 sides. These terms can also be used in contexts such as "we are playing with d8s".

- Since a fundamental mechanic of *Dice Duels: Duel of the Eights* is that of re-rolling dice, an additional variable will be added to the notation to denote the number of rolls, AdXrB. For example, typical Yahtzee with 3 rolls would be denoted as 5d6r3.

- Dice typically take the forms of platonic solids, meaning where the dice faces are congruent regular polygons. The five such polyhedra are:

  - A tetrahedron has four faces (d4)
  - A cube has six faces (d6)
  - An octahedron has eight faces (d8)
  - A dodecahedron has twelve faces (d12)
  - An icosahedron has twenty faces (d20)

Other die shapes can be used such as a pentagonal trapezohedron with ten faces (d10) or even dice meant to be rolled lengthwise such as a triangular prism which despite having five total faces, is used as having three (d3), or has caps to prevent rolling an unintended face.

- Dice rolls indicate a value integer when rolled. These can be represented by the numeric value of the integer or by representing the integer value as dots, called pips.

- In typical Yahtzee some patterns for scoring have terms. These will have to be added to and abstracted for a game with a different number of dice, but for a 5d6r3 these would be the scoring opportunities:

  - Rolling for aces, twos, threes, fours, fives, or sixes is rolling for as many of the number.
  - Chance is any combination of dice as a sum of all dice values.
  - A yahtzee is rolling all five of five dice with matching faces.
  - A three of a kind is having at least three of five dice match. For four of a kind, it is having at least four dice the same.
  - A straight is a set of sequential dice values. This can come in the small straight variant with four sequential values, or a large straight where all five dice are part of a sequence.
  - A full house is having two dice of a kind and three of another.

- A gameplay mechanic where players perform their turns concurrently with outcomes revealed simultaneously is referred to as a "simultaneous turn-based mechanism" in this document.

- This document makes reference to "game settings" and "game modes" where game settings are some specific settings that players will be able to customize, such as the number and type of dice, scoring methods, time limits, etc. and any permutation of these settings can define a "game mode".

2.1.2 Goal Statements

These primary goals should be achieved in the development of our system, providing criteria for completeness. We have additionally organized stretch goals for further development, but they are not to be a metric for system completeness.

The goal statements are:

GS1: Enjoyable game. The project is more than just a capstone, and we need the game to be an enjoyable experience.

  - User feedback collection. Implement a simple feedback system such as rating or comments for use in interviews or surveys to gather player insight.

- Testing iteration. Conduct at least two rounds of user testing to identify and iteratively improve the system based on user experience.
- Quality assets. Ensure that graphics, animations, and sounds are of a quality to add positively to the overall enjoyment.

Measurement: Based on user feedback, a minimum of 75% consider the experience as enjoyable.

GS2: Online multiplayer functionality. We need to be able to connect two concurrent players to play the game together.

- Connection setup. Develop a server-client connection system where two players can connect.
- Game state synchronization. Each player's actions are to be reflected to both user outputs using real-time synchronization.
- Disconnection handling. Design a method to handle disconnections.

Measurement: Two players can connect such that both players can affect the game state and both players are notified of the updates.

GS3: Customizable game settings. Core game elements must be modifiable to create custom Yahtzee variants. As a goal we would need these options to be implemented:

- Dice quantity option. Create an interface element for users to select from at least three options for number of dice.
- Dice type option. Create an interface element for users to select from at least three options for type of dice. These different types of dice will have different number of faces.
- Scoring method option. Offer at least two scoring systems that can be used.
- Timer feature. Implement a timer that can be turned on or off, providing a countdown for turn time.

Measurement: The above options are implemented and are compatible with each another.

GS4: Preset game settings. By having some preset game configurations, it would allow players to more quickly learn the game or jump into an environment that has been tested.

- Create presets. Develop at least three preset configurations and test them for gameplay balance.
- Preset selection menu. Create a simple way to select a preset.

    – Preset names and description. Give each available preset a name and a brief description to help players understand them.

Measurement: At least three preset game configurations would be available for players to load up and play.

GS5: 3D dice rolling. Rolling the dice will need to be or look to be three dimensional to recreate the tactile feel of the original game.

    – Dice 3D models. Develop 3D dice models, or the appearance of such.

    – Dice interaction. Allow for user interaction with rolling dice through clicks or drags.

Measurement: Dice will have the appearance of the preset die shape, and of being rolled, based on a minimum of 75% of user feedback considering it so.

Additional stretch goal statements are the following, and can additionally be considered for when looking to add to the system's complexity and to better fulfill the intended goal of being an enjoyable game.
The stretch goals are:

SG6: Local multiplayer. This would allow for players to play together on a single computer, but would require a different user interface and allow for different user interactions.

    – Player input methods. Develop a system to handle inputs from multiple players on the same device.

    – User interface adjustments. Design a UI (user interface) layout suitable for two players sharing a single screen.

Measurement: The ability for two players to play together using a single interface and game instance without an internet connection.

SG7: Singleplayer variants. A singleplayer game could be achieved either through a computer-run opponent in a game, or through a custom designed experience that could leverage the different environment.

    – AI opponent development. Create an AI that can play against a human player.

    – Difficulties. Design and allow players to adjust the AI opponent difficulty.

    – Solo game modes. Design at least one unique solo challenge or mode that provides a self-contained experience.

Measurement: A single person can play at least one variant made specifically to be singleplayer without requiring a second human player to update the game state.

SG8: Online matchmaking. The game would provide users with the option to connect to another concurrent user based on a matchmaking score.

– Player rating system. Develop a rating system to categorize players by experience and skill.

– Matchmaking algorithm. Implement a system to match players.

Measurement: A player can connect to another unknown concurrent player who was selected as a compatible opponent.

SG9: Saving custom game setting. Having this ability would allow for a user who created a custom game variant to save them for the ability to replay it without the need to recreate those specific settings.

– Save and load system. Build a system for players to save custom setting to a file or local storage.

– Edit and delete options. Allow players to edit or delete saved custom settings for better management.

Measurement: A custom game variant, as per the "Customizable game settings" goal and "More game setting customization" stretch goals, can be saved locally and loaded up to be played.

SG10: More game setting customization. Besides the options in the goals section, some additional game customization options would include:

– Scorecard customization. Provide methods for players to adjust what options and hands appear on the scorecards.

– Scoring points options. Offer players the ability to modify the scores of scoring options.

– Additional scoring mechanisms. Include options for different methods of round or game scoring.

– Gambling mechanism. Add additional ways to act on probabilities such as wagering on specific rolls.

– Feedback-based features. Gather ideas through user feedback and testing to further expand available customization options.

Measurement: Additional game options outside the ones listed in the "Customizable game settings" goal would be available.

SG11: Dice customization. Dice could be made to appear differently, either as a means for personalization or for aiding with different impairments. An example could be a dice with pips versus a dice with a numbered faces.

- Dice colour options. Create at least three different dice appearances.
- Dice number representation. Create different ways to represent dice face values such as traditional pips, numbers, and symbols.
- Personalization menu. Implement a menu to allow for easy selection of dice appearance.

Measurement: At least five different dice appearance variants players can choose from, that would appear in the game.

SG12: Post game statistics. This could allow for players to analyze a game after completion in a more quantitative manner, aiding in better understanding statistical probabilities.

- Key statistic tracking. Track important game stats during play.
- Post-game summary screen. Present collected stats on a summary screen after a game.

Measurement: A post-game summary showing at least three key game stats, available after each game.

SG13: Multi-platform support. While most gaming experiences are for windows, this would allow for the game to be run on more than just the Windows operating system, allowing for a wider audience.

- Compile for systems. Compile the created system for other operating systems.
- Platform testing. Test the game on multiple operating systems.
- Cross-platform functionality. Verify the features such as online multiplayer work across different operating systems.

Measurement: The game can be run on operating systems other than Windows.

SG14: Dice highlighting. This would aid in determining what dice are used when scoring.

- Automatic dice highlighting. Implement a system to automatically highlight the dice that contribute to a player's score.
- Optional setting. Allow players to enable or disable the feature.

Measurement: Dice used in scoring will be highlighted when appropriate.

2.2 Solution Characteristics Specification

This section, along with Physical System Description are not included within our document and have been removed from the template. The purpose of this section is to reduce the problem into one expressed in mathematical terms. Mathematical expertise is used to extract the essentials from the underlying physical description of the problem, and to collect and substantiate all physical data pertinent to the problem. Important elements that might otherwise have been in this section can be found in other sections where they may be more pertinent. Given the focus of this section on the physical description, and the fact there is no physical description as we have a software based project that is mostly hardware agnostic where the operating system would be more pertinent to the execution of the program.

3 Stakeholders

The stakeholders for this game project are those with vested interests in its development, release, and continued use. While there may be individuals with vested interest in *Dice Duels: Duel of the Eights*, they all fall within the broader categories below and generally act as a member of the whole rather than an individual stakeholder. Stakeholders for the capstone but not for the project itself are included in some sections below, but are not considered a stakeholder of the project due to not influencing the direction and development of the game outside of requiring a certain challenge level and documentation.

3.1 Traditional Yahtzee enthusiasts

- **Demographics:** Generally older players who have nostalgia for the classic Yahtzee game. They may have experience with the physical dice game playing with family and friends and seek a familiar experience to bring back memories and connect with people.

- **Technical Comfort Level:** May be lacking in experience with technology and be more comfortable with straightforward, user-friendly interfaces and are likely to appreciated clear instructions.

- **Motivations:**

  - *Nostalgia.* They seek to relive the classic Yahtzee experience in a more accessible format.
  - *Social connection.* They are interested in playing with friends they may not be able to meet in person.
  - *Relaxed gameplay.* They generally prefer low-stakes slower-paced gameplay that doesn't require complex strategies or fast decision making. They are more likely to appreciate a more relaxed experience.

- **Preferences:**

  - *Classic game mode.* They'll likely be drawn to a game mode that replicates the original Yahtzee experience.
  - *Simplicity over customization.* While they may be willing to try out some customization, they may prefer options that don't stray too far from the classic.
  - *Minimalistic design.* An interface that's easy on the eyes with intuitive navigation will help make the experience enjoyable for them.

3.2 Video Game enthusiasts

- **Demographics:** A diverse group spanning casual players to more experienced players focused on optimization, they are familiar with online multiplayer games and are comfortable with technology and video games.

- **Technical Comfort Level:** Most typical gamers are comfortable with technology, online multiplayer, and faster-paced games. They enjoy exploring game mechanics and may be open to more complex overlapping game mechanics. Are comfortable downloading a new video game with straightforward procedures.

- **Motivation:**

  - *Challenge and skill expression.* They're interested in games that allow for strategy and competitive play where skill and quick decision-making have an impact on the outcome.
  - *Engagement.* Video game enthusiasts seek a fast-paced experience with more action and reward cycles that provide instant feedback and keep them engaged.
  - *Replayability.* They generally enjoy experiences with unique challenges every time they play and can develop strategies over multiple runs.

- **Preferences:**

  - *Customization and variability.* They are likely to appreciate the ability to customize gameplay to explore possibilities and develop a game system that is challenging but enjoyable for them.
  - *Faster game modes.* They may enjoy options that speed up gameplay, such as round timers or different scoring methods that add intensity and variety.
  - *Reactive feedback.* Faster-paced action and instant feedback to keep them engaged would be preferred over slower gameplay.

3.3   Personas

- **Joan, 55 years old (The Nostalgic Yahtzee Player)** Joan enjoys simple board games that remind her of family gatherings. She values a straightforward interface, classic gameplay, and the option to play casually with friends over the internet when they cannot meet in person.

- **James, 24 years old (The Casual Gamer)** James plays games on the weekends with friends. He enjoys the flexibility of customizable game modes and fast-paced rounds. Alex values multiplayer gameplay with friends and occasional solo play.

- **Julian, 19 years old (The Competitive Gamer)** Julian enjoys strategic games that involve skill, competition, and learning over time. He prefers playing with friends that are similarly competitive, customization options, and post-game statistics to analyze his performance.

3.4 Priorities Assigned to Users

- **Primary Priority:** Casual and competitive video game enthusiasts would be the primary priority as they are the most plentiful and would be most likely to come across the game to play it. There is currently no game that provides customizable Yahtzee-like mechanics, and with feedback and testing, the game can be made to tailor to their preferences and be engaging.

- **Secondary Priority:** Traditional Yahtzee enthusiasts are a secondary priority in that using customization mechanics their preferred classic game can be recreated, but the game system overall would be more than just that. Their needs for a simple and intuitive user interface must be taken into consideration, as must options be available for their experience to likewise be enjoyable.

- **Tertiary Priority:** Outside of the context of stakeholders for the program, there are stakeholders for the capstone project. Their considerations do not shape the game itself as they are unlikely to play the game, but rather require a specific challenge level and documentation to be produced. As such, they can be considered tertiary despite not being stakeholders to the game unless also included in one of the above stakeholder groups.

3.5 User Participation

- **Development Phase:** Selected playtesters and the development team will regularly engage with the game throughout the development cycle to identify bugs and shape the user experience.

- **Testing Phase:** Both playtesters and target user groups will participate in beta testing to validate usability, customization options, and multiplayer functionality.

- **Feedback Phase:** In the feedback phase, when functionality is mostly validated, users will provide feedback through surveys and interviews to refine the game before a final release.

3.6 Ongoing Support

This project will be released with a final build that is complete and of quality. Since this game will also be released under a permissive license, the codebase will be publicly available on GitHub, allowing others to further develop it and add features they themselves may wish to have available, or fix any bugs that may be present. The current developers may also be available in their free time if this project or a spin-off is something that will continue past the capstone project timeframe.

4 Standards, Codes, Legal, and Regulatory Factors

Developing an online multiplayer game requires adherence to various standards, codes, legal, and regulatory factors to ensure a safe, fair, and compliant gaming experience. The following standards are identified for the multiplayer aspect of the game, especially in the context of player-versus-player (PvP) matches:

4.1 Data Privacy and Protection

- **GDPR (General Data Protection Regulation)**: Given that the game may involve players from the European Union, compliance with GDPR is essential. This includes ensuring user consent for data collection, providing clear privacy policies, and safeguarding player data.

- **CCPA (California Consumer Privacy Act)**: If players are based in California, the game must comply with CCPA to give users control over their personal information.

- **COPPA (Children's Online Privacy Protection Act)**: If the game targets children under 13, compliance with COPPA is mandatory to protect children's privacy.

4.2 Network and Online Standards

- **IEEE 802.11 (Wi-Fi Standards)**: Ensuring reliable local area network (LAN) connectivity follows IEEE 802.11 standards to provide consistent communication quality.

- **WebSockets (RFC 6455)**: The use of WebSockets for real-time communication between players must comply with RFC 6455 to ensure reliable, secure data exchange.

4.3 Game Fairness and Anti-Cheating Measures

- **ISO/IEC 27001 (Information Security Management)**: Implementing practices from ISO/IEC 27001 helps in managing game security, reducing the risk of cheating, and protecting the game from malicious activities.

- **Fair Play Guidelines**: To ensure fair play in PvP matches, the game should adopt fair matchmaking and anti-cheating measures, such as monitoring unusual behavior and implementing server-side verification of actions.

4.4 Legal Considerations for Online Play

- **Terms of Service and End-User License Agreement (EULA)**: A clear EULA must be provided, detailing acceptable behavior, limitations of liability, and consequences for misuse or cheating.

- **Content Rating Standards**: The game must be rated appropriately, such as following the **ESRB (Entertainment Software Rating Board)** or **PEGI (Pan European Game Information)** standards, to ensure suitability for the intended audience.

4.5   Accessibility Standards

- **WCAG (Web Content Accessibility Guidelines) 2.1**: For an inclusive experience, the game's online features and user interface should follow WCAG 2.1 guidelines, ensuring accessibility for players with disabilities.

4.6   Intellectual Property and Copyright

- **Copyright Compliance**: The game must avoid unauthorized use of copyrighted material, including sound effects, graphics, and other assets. Original content must be used, or appropriate licenses must be obtained.

- **Trademark Considerations**: Any use of trademarks must be properly authorized to avoid infringement issues.

4.7   Regulatory Requirements for Online Play

- **Online Gambling Regulations**: If any aspect of the game involves virtual currency or random rewards, it may fall under online gambling regulations in certain jurisdictions. The game must be reviewed for compliance with applicable laws to avoid any unintended legal issues.

- **Consumer Protection Laws**: Compliance with consumer protection laws is crucial, ensuring transparency in in-game purchases and providing users with refund policies.

By adhering to these standards, codes, and legal factors, the development of the online multiplayer game will ensure a fair, compliant, and enjoyable experience for all players, while minimizing legal and regulatory risks.

5   Standards Compliance Roadmap

The following compliance roadmap outlines when each of the identified standards will be adhered to during the development of the online multiplayer game:

- **Data Privacy and Protection (GDPR, CCPA, COPPA)**: Compliance will be met by the Final Demo.

- **Network and Online Standards (IEEE 802.11)**: Compliance will be met by the Final Demo.

- **Network and Online Standards (WebSockets)**: Compliance will be addressed post-capstone based on the game's scale.

- **Game Fairness and Anti-Cheating Measures (ISO/IEC 27001)**: Compliance will be addressed post-capstone based on the game's scale.

- **Game Fairness and Anti-Cheating Measures (Fair Play Guidelines)**: Compliance will be met by the Final Demo.

- **Legal Considerations for Online Play (Terms of Service, EULA, Content Rating Standards)**: Compliance will be met by the Final Demo.

- **Accessibility Standards (WCAG 2.1)**: Compliance will be addressed post-capstone based on the game's scale.

- **Intellectual Property and Copyright (Copyright Compliance, Trademark Considerations)**: Compliance will be continuously verified, with final verification by the Final Demo.

- **Regulatory Requirements for Online Play (Online Gambling Regulations)**: Compliance may be required post-capstone based on the direction of the game and will be evaluated accordingly.

- **Regulatory Requirements for Online Play (Consumer Protection Laws)**: Compliance will be met by the Final Demo if the game direction leads to the introduction of in-game purchases.

6   Likely Changes

LC1: Adding more ways to find opponents to play with (single player, local multiplayer on same device, etc)

- After setting up our initial on-line multiplayer and making sure that the online multiplayer is stable, we can expand our projects scope by adding other ways that users can find opponents to play against, such as a singleplayer gamemode against an algorithmic opponent, or a local multiplayer mode that can be played on the same device.
- This relates to the following requirements:
    * GS2: Online multiplayer functionality
    * SG6: Local multiplayer
    * SG7: Singleplayer variants
    * SG8: Online matchmaking

LC2: the amount and variability of dice options may increase and decrease based on the scope of the project

- As the Scope of our project increase and decreases, we will consider experimenting with different amounts and types of dice.
- This relates to the following requirements:
    * GS3: Customizable game settings

LC3: We may expand comparability to other operating systems depending of the scope of the project (Mac OS, etc).

- While we will initially design our system to work on Windows 10/11 devices, should the scope of our project expand, we are likely to adapt our system to work on other OS systems too such as Mac OS, or Linux, allowing our product to reach more players.
- This relates to the following requirements:
    * SG13: Multi-platform support

LC4: We may change how the scores are calculated.

- As we change and add various options for the players, such as changing the number and types of the dice, we may need to account for the different probabilities that these new options may create, which in turn would require us to modify our scoring system to account for these radically different probabilities.

- This relates to the following requirements:
  * GS3: Customizable game settings
  * SG10: More game setting customization

LC5: We may expand the amount of players that can play the same game from just the initial 2 depending on scope.

- While initialized for two players, it is known that Yatzee can easily support more players, given that the fundamental mechanics of the game don't change when you add them. Thus, when we stabilize our two-player multiplayer, we could expand upon it to allow more then the initial two players to play the same game, allowing more users to enjoy our product.
- This relates to the following requirements:
  * SG10: More game setting customization

7 Unlikely Changes

UC1: We will not remove the multi-player component of the game.

- The game is inherently a social game that involves chance and strategy in an attempt to get the highest score compared to other players, As such multiplayer is a core component of the game and it must be included to ensure that an important aspect of the game isn't lost.
- This relates to the following requirements:
    * GS1: Enjoyable game
    * GS2: Online multiplayer functionality
    * SG6: Local multiplayer

UC2: We will not remove the dice and it's probabilities

- Dice are a critical component of Yahtzee and it's variations, and the probabilities that the dices rolls provide are a core component in the way that score is calculated in game. Thus, our game will always involve the usage of dice and the calculation of the probabilities involving them.
- This relates to the following requirements:
    * GS3: Customizable game settings
    * GS5: 3D dice rolling

UC3: We will not switch from our engine Godot for the duration of the project.

- After conducting research on other game engines, and comparing our options, we have concluded that the Godot engine is the game engine best suited for our project and that would help us best achieve all our requirements but especially related to the following requirements:
    * SG13: Multi-platform support

UC4: We will always have customization between game variants, and not just presets.

- One of the selling points for this project is to have customised settings for our game, allowing the user to tailor their experience to the way they want it. Thus, it is unlikely we will alter our plans to include this feature.
- This relates to the following requirements:
    * GS4: Preset game settings
    * GS3: Customizable game settings
    * SG10: More game setting customization

     ∗ SG9: Saving custom game setting

UC5: We will not change the 3D format of our game to 2D

   – When playing a physical game like Yahtzee, one of the most engaging aspects is the action of rolling the dice. We wish to recreate the feel of playing the physical game as closely as possible by allowing our player to be able to visually see the dice roll in a way that mirrors the physical experience.

   – This relates to the following requirements:

     ∗ GS5: 3D dice rolling

8 Development Plan

Please refer to separate development plan located in docs: link

9 Values of Auxiliary Constants

This section, titled "Auxiliary Constants," has been intentionally omitted as it is more appropriate for documents that require the definition and organization of numerous constants and parameters. In the context of our project, which focuses on the game variants, the need for such a section is minimal.

The constants and parameters relevant to the game family are already comprehensively addressed in other parts of this document, particularly within the sections dealing with Commonalities, Variabilities, and Parameters of Variations. These sections provide all necessary explanations and definitions in a self-contained manner. Given that these parameters are specific to certain features of the game and are clearly outlined where applicable, adding an additional section on auxiliary constants would be redundant and not add any meaningful value to the document. Therefore, we have chosen to skip this section for the sake of clarity and to avoid unnecessary duplication.

10 Variabilities

This section details the variabilities between the different games in the product family, including changes in UI elements, game goals, and core mechanics.

10.1 Number of Dice

The number of dice used in the game can vary between different versions. Some variants may increase or decrease the number of dice to adjust the complexity and strategy of the game.

10.2 Sides on Dice

The number of sides on each dice can differ across game variants. This allows for customization of gameplay, where different variants may feature dice with more or fewer sides, influencing the probability and outcomes of each roll.

10.3 Individual Sides

The specific values or symbols on the sides of each dice can vary between versions. This variability provides an opportunity to introduce different themes or scoring dynamics depending on the game's rules.

10.4 Scoring Calculation

How points are calculated for different hands and the influence of dice rolls on the final score can be customized in different game variants. This allows for changes in how specific hands are valued and how scoring impacts the overall gameplay strategy.

10.5 Time Per Turn

The amount of time a player has to roll the dice and make their selection can be adjusted between variants. Time limits can vary, creating different levels of pressure and pacing in the game.

10.6 Hand Restrictions

Some game variants may restrict certain hands from being scored or may allow hands to be scored multiple times. These variations provide flexibility in game strategy and scoring dynamics.

11 Parameters of Variations

This section details the specific values that the variabilities between the different games in the product family can take, corresponding to the variabilities outlined in the previous section.

11.1 Number of Dice

The number of dice used in the game can range from 1 to a maximum based on testing results. Having a high maximum would allow for more customization options, but a reasonable limit based on what is realistically usable and fun but also based on physics simulation performace needs to be set. This allows for variations in gameplay complexity, depending on the specific variant.

11.2 Sides on Dice

The usable dice will be a subset of dice modeled with the following number of sides: 4, 6, 8, 10, 12. This flexibility in dice sides introduces variability in the probability and potential outcomes for each roll.

11.3 Individual Sides

The values displayed on the individual sides of each die can range from 1 to the respective number of sides on that die and can be displayed in different representations. This variability allows for different numerical or symbolic configurations to match specific game variants.

11.4 Scoring Calculation

Each hand can be assigned any integer score value or modified by factors based on the dice rolls. This provides flexibility in defining how each hand is valued in the different game variants.

11.5 Time Per Turn

The time allotted for each turn can range from 5 seconds to 2 minutes, or be set to unlimited. This parameter affects the pacing of the game, allowing for both fast-paced and more thoughtful gameplay.

11.6 Hand Restrictions

Hands can be restricted by removing up to all but one from play. Additionally, hands can be allowed to be repeated between 1 to 10 times or an unlimited number of times, giving options for different scoring strategies.

References

Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning.

1. What went well while writing this deliverable?

   - The SRS document had a lot of work to be done in a lot of sections. In an effort to mitigate merge conflicts and better divide the workload, a main SRS.tex file was created which would reference and include other .tex files which contain the information for the sections. - John P.

   - All team members were able to contribute to the document. Sections were divided up well so that each team member could focus on their own specific part. - Isaac G.

   - Team members communicated often and effectively. - Isaac G.

   - Code changes were handled well as described in our workflow plan such that we were able to keep track of changes and avoid merge conflicts. - Isaac G.

2. What pain points did you experience during this deliverable, and how did you resolve them?

   - Since out project is solely a software without any hardware components or dependencies, the template was a little difficult to navigate. While we used the default SRS template as guidance, we made use of inspiration from the Volere SRS template for sections that would be more relevant to our own and removed sections that were not relevant from the default SRS template. - John P.

   - Some sections for this SRS were not entirely clear and some sections were not very applicable to our specific project. We were however able to meet with our TA to iron out some of these issues and find a clear path forward. - Isaac G.

   - Our project was able to benefit from a commonalities section but this is not something that any of us knew how to do. But through some discussion with the prof and some research, Nigel was then able to look into this issue and ultimately did a great job building out the commonalities section for the team. - Isaac G.

   - With many busy shedules finding time to meet and work was a challenge. We were however able to compare shedules and find meeting times that we could all make, and everyone communicated well to let team members know when they would have time to get to their part(s) of the deliverable done. - Isaac G.

3. How many of your requirements were inspired by speaking to your client(s) or their proxies (e.g. your peers, stakeholders, potential users)?

- Our primary stakeholders are those who would be interested in playing the game, so indirectly we are members of the stakeholder group as well as our supervisor. As such, through consensus and group discussion, game mechanics that would be interesting and enjoyable were drawn up which determine most of our functional requirements. - John P.

- Our look and feel requirements are all inspired by speaking with potential users. - Isaac G.

- Our functional requirement for being able to customize the dimensionality of our dice is inspired by our supervisor who is a stakeholder. - Isaac G.

4. Which of the courses you have taken, or are currently taking, will help your team to be successful with your capstone project.

- For the calculations of probabilities, SFWRENG 4E03 proved to be helpful and discrete time markov chains were used to determine probabilities in rolls and how many of a kind. - John P.

- In thinking how we are to organize the program in terms of architecture styles, SFWRENG 3A04 is helpful in providing examples and information on different architectures and their applications. - John P.

- Since our project is a game, there will be constant player input and output and interaction through an interface. As such, SFWRENG 4HC3 provided helpful information on the design of user interfaces and principles of good interface design. - John P.

- All of our software design courses will be crucial for the initial planning phases of this project. And these courses were key to the development of our skillsets relating to gitflow and large project setups. - Isaac G.

- Our software testing and requirements course is proving to be useful now and will likely continue to be useful as the project continues. - Isaac G.

- Our object oriented programming course will be useful when coding the project. - Isaac G.

- Our engineering project courses (1P13, 2PX3, 3PX3) are also helpful for many of the planning schemes that we use and for the familiarity that they have provided us with group work. - Isaac G.

5. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.

- I will need to learn to develop in Godot, as that is the game engine we will be using, as well as learning C# as a language. I have also already learnt more GitHub that before with branched, merging, issues, etc. Finally, I hope to further explore probability throughout this project and more advanced calculations such as DTMC. - John P.

- All team members will need to develop a strong working understanding of the Godot game engine and associated coding language. - Isaac G.

- 2D design skills should be developed by at least 1 team member to be able to create visually appealing user interfaces and graphics. - Isaac G.

- 3D design skills should be developed by at least 1 team member to be able to create visually appealing 3D assets for the game. - Isaac G.

6. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?

- In terms of learning Godot, there are many online tutorials that can be found and followed along, and all of us should be making use of this resource before we contribute to the project to become accustomed to the process. A second way to acquire experience in Godot is through making a small project on our own once we have followed the online tutorials. This would also be the case for C# and the scripting that is available in Godot. - John P.

- To learn about the Godot game engine and its coding language, team members can read the documentation, watch tutorials, and follow along in making sample Godot projects. This will be the primary method of learning for all team members. - Isaac G.

- I(Isaac) will focus on Godot because I have game development experience and feel very comfortable with coding. I also do not feel that artistically inclined which is most beneficial for 2D and 3D design. - Isaac G.

- To learn about 2D design, team members can watch tutorials and practice using software like Photoshop, GIMP, or PAINT.NET. - Isaac G.

- To learn about 3D design, team members can watch tutorials and practice using software like Blender. - Isaac G.