

Software Requirements Specification for ProgName: subtitle describing software

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September 30, 2025

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Revision History

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

1 Purpose of the Project

1.1 User Business

The purpose of this project is to design and implement an educational card game based on the traditional *Crazy 8s* rule set, but adapted to integrate the **Dozenal (base-12) number system**.

- This project addresses the lack of accessible and engaging tools that introduce alternative number systems in a playful and intuitive way.
- By combining a familiar card game mechanic with Dozenal representations and operations, users can gradually build comfort and intuition with the base-12 system.
- The primary business value lies in providing a lightweight, fun, and interactive educational tool for students, hobbyists, and anyone interested in number systems beyond decimal.

Additionally, the game offers an opportunity to evaluate how gamification can support mathematical learning, and whether abstract concepts (such as base conversions or divisibility in Dozenal) can be effectively taught through play.

1.2 Goals of the Project

The goals of this project are:

- **Educational Integration:** Seamlessly incorporate Dozenal concepts (symbols 0–B, factorization, arithmetic) into the gameplay, ensuring that players learn by playing without requiring formal prior knowledge.
- **Gameplay Design:** Deliver a working digital version of *Crazy 8s* that is intuitive, responsive, and enjoyable, while maintaining the familiar flow of the original game and introducing Dozenal-specific mechanics (e.g., matching rules, scoring, or special cards).
- **Accessibility and Engagement:** Create a user-friendly interface that lowers the barrier to learning, accessible for casual users while offering depth for learners who want to explore Dozenal further.

- Scalability / Stretch Goals: Explore the potential for extending the system to other educational card or board games, and investigate how different number bases can be taught through similar game mechanics.

2 Stakeholders

2.1 Client

Insert your content here.

2.2 Customer

Insert your content here.

2.3 Other Stakeholders

Insert your content here.

2.4 Hands-On Users of the Project

Insert your content here.

2.5 Personas

Insert your content here.

2.6 Priorities Assigned to Users

Insert your content here.

2.7 User Participation

Insert your content here.

2.8 Maintenance Users and Service Technicians

Insert your content here.

3 Mandated Constraints

3.1 Solution Constraints

- All source code must be managed using Github, with frequent commits and version control.
- The system must be developed using React for frontend and Node.js for backend.

3.2 Implementation Environment of the Current System

- The backend must operate on Node.js (LTS version, e.g., 18+) with a relational database such as PostgreSQL or MySQL.
- The application must be deployable on modern web browsers (Chrome, Firefox, Edge)

3.3 Partner or Collaborative Applications

- The team must use GitHub for code collaboration and issue tracking.
- Discord are required for real-time communication and coordination.

3.4 Off-the-Shelf Software

- The system must rely primarily on open-source libraries.
- Proprietary software must not be required for end users to run the application.

3.5 Anticipated Workplace Environment

- End users are expected to interact with the application primarily on web browsers.

3.6 Schedule Constraints

- The project must be completed within the academic deadline.
- Progress reports and milestone check-ins with the TA are mandatory.

3.7 Budget Constraints

- Total financial budget is under 500 Canadian Dollars.
- Open source and free tools are primary to be used.

3.8 Enterprise Constraints

- The project must comply with academic integrity and university policies.
- Data collection and storage must follow privacy, security, and ethical guidelines.

4 Naming Conventions and Terminology

4.1 Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project

- **Base-10 (Decimal)**: The standard numerical system using ten digits (0–9), commonly used in arithmetic and everyday calculations.
- **Base-12 (Dozenal)**: A numerical system using twelve digits (0–9, A, B), where A represents 10 and B represents 11 in decimal. Has divisibility advantages (divisors: 2, 3, 4, 6).
- **Crazy Eights**: A classic card game where players match cards by suit or rank, with the “8” card acting as a wild card allowing the player to declare a new suit.
- **MVP**: Minimum Viable Product, the initial version of the Crazy Eights software with core functionality, including two-player gameplay, classic rules, and dozenal scoring.

- **Functional Goals:** Features and behaviors the software must implement, such as gameplay mechanics and dozenal score display.
- **Non-functional Goals:** Quality attributes of the software, such as usability, performance, and stability.
- **Stretch Goals:** Optional features or enhancements, such as multi-player support or advanced dozenal rule variants, to be implemented if time permits.
- **GitHub:** The platform used for version control, issue tracking, and Kanban board management.
- **Discord:** The communication platform for team coordination, quick updates, and voice meetings.
- **Kanban Board:** A project management tool in GitHub Projects, divided into stages (Backlog, In Progress, Review, Done) to track tasks.
- **CI/CD:** Continuous Integration/Continuous Deployment, an automated process for testing and deploying code changes.
- **SRS:** Software Requirements Specification, this document outlining the requirements for the Crazy Eights project.
- **PoC:** Proof of Concept, a prototype demonstrating core gameplay mechanics to validate feasibility.
- **UI:** User Interface, the visual and interactive components of the software, such as the game board and score display.

5 Relevant Facts And Assumptions

5.1 Relevant Facts

Insert your content here.

5.2 Business Rules

Insert your content here.

5.3 Assumptions

Insert your content here.

6 The Scope of the Work

6.1 The Current Situation

The current numerical system used around the world is predominantly decimal (base-10). This system, while widely adopted, has limitations in representing fractions cleanly, as its prime factors (2 and 5) result in recurring decimals for simple ratios $1/3$ or $1/6$. On the other hand, the dozenal (base-12) system, with divisors 2, 3, 4, and 6, offers a more intuitive and concise fraction representations, historically used in trade and measurement systems (e.g., dozens, hours). However, dozenal is underutilized in education and practice, leaving students, educators, and professionals reliant on decimal despite its inefficiencies for certain calculations. There is no current fun and engaging way to demonstrate the practical advantages of dozenal, such as a card game like Crazy Eights, to promote its adoption.

6.2 The Context of the Work

The project focuses on the software implementation of the Crazy Eights card game that incorporates dozenal (base-12) scoring and display to highlight the benefits of the dozenal system. The context includes:

- **Educational Context:** The project will simplify mathematical understanding for the user by showing dozenal's advantages in a familiar and fun game format.
- **Technical Context:** The software will be developed using a modern tech stack for web applications (JavaScript, TypeScript, Node.js, React, PostgreSQL) and use GitHub CI/CD pipelines for version control and testing.
- **Stakeholder Context:** Key stakeholders include students, educators, mathematicians, computer scientists, and the general public, all of whom could benefit from clearer fraction representations and easier mental arithmetic.

6.3 Work Partitioning

The workload is divided into the following major phases, aligned with the development plan:

1. **Problem Definition and Planning (Weeks 3–4):** Draft problem statement, development plan, and initial proof of concept (PoC) to establish scope and feasibility.
2. **Requirements and Hazard Analysis (Week 6):** Develop the SRS and identify potential risks and mitigation strategies.
3. **Verification and Validation Planning (Week 8):** Define testing strategies to ensure the software meets functional and non-functional requirements.
4. **System Design (Weeks 10–16):** Create and refine architecture diagrams, decompose the system into modules (frontend, backend, database, API), and document extensibility.
5. **Implementation and Testing (Weeks 11–19):** Develop the MVP (two-player game with classic rules and dozenal scoring), conduct unit and integration testing, and prepare for demonstrations.
6. **Demonstrations and Refinement (Weeks 19–24):** Conduct Revision 0 and final demonstrations, incorporating feedback to improve functionality and performance.
7. **Final Documentation and EXPO (Week 26):** Finalize documentation and present a polished product at the EXPO.

Each task is tracked via GitHub Issues and the Kanban board, with responsibilities assigned to team members based on rotating roles (developer, reviewer, meeting chair, note-taker).

6.4 Specifying a Business Use Case (BUC)

BUC: Play a Game of Crazy Eights with Dozenal Scoring

- **Actors:** Two players, the software system.

- **Trigger:** A player creates a new game session using the UI.
- **Description:** Two players take turns matching cards by suit or rank, with the “8” card acting as a wild card that allows the player to declare a new suit. If no valid move can be made, the player draws from the stock pile. The game ends when one player discards all their cards, and the score is calculated and displayed in dozenal notation.
- **Preconditions:** The user is logged in. The software is running on a web interface, with a functional UI displaying the hand, discard pile, stock pile, and score tracker.
- **Postconditions:** The game concludes with a winner, points are displayed in dozenal and must be counted by the users to see the final score. The user can log Off or start a new game.
- **Basic Flow:**
 1. The system deals cards to both players and initializes the discard pile with a starter card.
 2. Players take turns, selecting a card to play (matching suit or rank) or drawing from the stock pile.
 3. If an “8” is played, the player selects a new suit via the UI.
 4. The system checks moves and gives immediate feedback for invalid moves.
 5. The game keeps going until one player has no cards left, triggering user score counting and calculation challenge in dozenal.
 6. The system displays the final score.
- **Exceptions:**
 - Invalid move attempted: The system highlights the error and prompts the player to select a valid card or draw.
 - Stock pile exhausted: The system reshuffles the discard pile to replenish the stock pile.
- **Assumptions:** Players are familiar with basic card game mechanics and the system supports a stable internet connection for play.

7 Business Data Model and Data Dictionary

7.1 Business Data Model

These are the key entities and relationships involved in the Crazy Eights game with dozenal scoring.

- **Entities:**

- **Player:** Represents a game participant, holding a hand of cards and a score.
- **Card:** Represents a single playing card with a suit and rank.
- **Deck:** A collection of cards, divided into the stock pile and discard pile.
- **Game Session:** Tracks the state of a single game, including players, current turn, discard pile, and scores.
- **Score:** Tracks points in dozenal notation, calculated based on game rules.

- **Relationships:**

- A **Game Session** has 2 **Players** (MVP) or 2–4 **Players** (stretch goal).
- Each **Player** has a **Hand** (subset of **Cards**).
- A **Deck** consists of 52 **Cards**, split into **Stock Pile** and **Discard Pile**.
- A **Game Session** produces a **Score** for each **Player** in dozenal notation.
- A **Card** played in a **Game Session** affects the **Discard Pile** and may trigger a suit change (if an “8”).

7.2 Data Dictionary

- **Player:**

- **ID:** Unique identifier for a player (integer).
- **Name:** Display name for the player (string).

- **Hand:** List of cards held by the player (array of Card objects).
- **Score:** Player’s cumulative score in dozenal notation (string, such as “1A” for 22 in decimal).
- **Card:**
 - **Suit:** One of four suits (Hearts, Diamonds, Clubs, Spades) (string).
 - **Rank:** Card value (2–10, J, Q, K, A, 8) (string).
 - **IsWild:** Boolean indicating if the card is an “8” (true/false).
- **Deck:**
 - **Stock Pile:** List of cards available for drawing (array of Card objects).
 - **Discard Pile:** List of played cards (array of Card objects).
- **Game Session:**
 - **Session ID:** Unique identifier for the game session (string).
 - **Current Turn:** ID of the player whose turn it is (integer).
 - **Status:** Game state (Active, Completed) (string).
 - **Starter Card:** The first card in the discard pile (Card object).
 - **Last Played Suit:** The active suit after an “8” is played (string).
- **Score:**
 - **Player ID:** Links to the player (integer).
 - **Dozenal Value:** Score in base-12 notation (string, such as “14” for 16 in decimal).
 - **Calculation Method:** Rules for scoring (sum of remaining cards in the opponents hands) (string).

8 The Scope of the Product

8.1 Product Boundary

Insert your content here.

8.2 Product Use Case Table

Insert your content here.

8.3 Individual Product Use Cases (PUC's)

Insert your content here.

9 Functional Requirements

9.1 Functional Requirements

Insert your content here.

10 Look and Feel Requirements

10.1 Appearance Requirements

- **Layout:** The user interface must have a clean and minimalistic layout, ensuring readability and ease of navigation.
- **Responsiveness:** The system must be responsive, adapting automatically to different screen sizes.

10.2 Style Requirements

- **Consistency:** The application must follow a consistent design theme(e.g.: color, button style, typography).

11 Usability and Humanity Requirements

11.1 Ease of Use Requirements

- **Simplicity:** The interface must minimize the number of steps needed to perform core tasks.
- Data collection and storage must follow privacy, security, and ethical guidelines.

11.2 Personalization and Internationalization Requirements

- **Language Options:** The system must support at least English and one additional language for international users.

11.3 Learning Requirements

- **Onboarding** A short interactive tutorial must explain the rules of the game and how counting in different bases works.

11.4 Understandability and Politeness Requirements

- **Friendly Wording:** Prompts like “Invalid Move” must be displayed as polite guidance.
- **Clear Instructions:** Rules and base-conversion explanations must be phrased in simple and non-technical terms.

11.5 Accessibility Requirements

- **Keyboard Support:** All main actions must be accessible via keyboard shortcuts

12 Performance Requirements

12.1 Speed and Latency Requirements

- **Low latency:** Game actions must update across all players’ screens within 300 ms.
- **Fast loading:** The game lobby and first match must load within 5 seconds on a stable internet connection.

12.2 Safety-Critical Requirements

- **Cheat Prevention:** The system must prevent unauthorized manipulation (e.g., directly altering game state through client-side tools).

- **Data Integrity:** No game state (e.g. deck composition, player hand) should be lost or corrupted due to refresh or reconnect.

12.3 Precision or Accuracy Requirements

- **Card Rules:** Card-matching and counting rules must be enforced with 100% accuracy according to the chosen numeral base.

12.4 Robustness or Fault-Tolerance Requirements

- **Reconnection:** If a player disconnects, they must be able to rejoin within 30 seconds without losing progress.

12.5 Capacity Requirements

- **Concurrent Players:** The system must support at least 200 concurrent users during testing.

12.6 Scalability or Extensibility Requirements

- **Game Modes:** The system must allow for adding new rule variations (e.g., different numeral bases or wild card effects) with minimal code changes.
- **Server Scaling:** The backend must be deployable in a scalable environment (e.g., Docker, cloud hosting) to handle larger user bases.

12.7 Longevity Requirements

- **Maintainability:** The codebase must be modular and documented, so future developers can update rules easily.

13 Operational and Environmental Requirements

13.1 Expected Physical Environment

Insert your content here.

13.2 Wider Environment Requirements

Insert your content here.

13.3 Requirements for Interfacing with Adjacent Systems

Insert your content here.

13.4 Productization Requirements

Insert your content here.

13.5 Release Requirements

Insert your content here.

14 Maintainability and Support Requirements

14.1 Maintenance Requirements

- **Code Maintainability:** The codebase must be modular, with clear separation of concerns to facilitate updates and debugging. Inline comments for non-obvious logic and updated README/module documentation are required, as specified in the development plan.
- **Version Control:** All changes must be tracked via GitHub, with descriptive commit messages and pull requests requiring at least one peer review to ensure maintainability.
- **Extensibility:** The system must support adding new features without requiring significant refactoring. This is achieved by using a modular architecture and Object oriented Design principles.
- **Documentation Updates:** Any change in behavior, interfaces, or setup instructions must be reflected in the documentation to ensure future developers can maintain the system. Local deployment instructions documented in the README to simplify setup for developers and maintainers.

14.2 Supportability Requirements

- **Error Reporting:** The system must provide clear, user-friendly feedback for invalid moves. Logs or replays of game sessions must be available for debugging, as specified in the non-functional goals.
- **User Support:** A tutorial or visual guidance (stretch goal) must be provided to assist new players in understanding gameplay and dozenal scoring. This reduces the need for extensive manual support.
- **Cross-Platform Support:** The software must run on different web environments (Windows, macOS, or browsers).

14.3 Adaptability Requirements

- **Rule Flexibility:** The system must support toggling house rules (e.g., draw-until-playable, stacking eights) via a rule configurator (stretch goal), allowing adaptation to different play styles without code changes.
- **Scalability for Players:** The architecture must accommodate extending from two-player (MVP) to 3–4 player games (stretch goal) by modifying session management and turn logic.
- **Numeric System Extensibility:** The scoring system must allow switching between dozenal and decimal displays, ensuring adaptability for users unfamiliar with base-12.

15 Security Requirements

15.1 Access Requirements

Insert your content here.

15.2 Integrity Requirements

Insert your content here.

15.3 Privacy Requirements

Insert your content here.

15.4 Audit Requirements

Insert your content here.

15.5 Immunity Requirements

Insert your content here.

16 Cultural Requirements

16.1 Cultural Requirements

- **Numeric System Accessibility:** The software must present dozenal (base-12) in an intuitive, non-disruptive way. This includes clear UI elements for dozenal scores (using A and B for 10 and 11) and optional tutorials (stretch goal) to explain dozenal notation to users unfamiliar with it.
- **Inclusivity:** The system must avoid cultural biases in its design, ensuring that gameplay and terminology (suits, ranks) are universally recognizable across cultures familiar with standard playing cards. No culturally specific references or imagery should be used in the UI to maintain broad accessibility.
- **Educational Alignment:** The software must align with educational goals by demonstrating the practical benefits of dozenal in a game context, making it appealing to students and educators. This supports the cultural shift toward exploring alternative numeric systems, as advocated by stakeholders like dozenal enthusiasts.

17 Compliance Requirements

17.1 Legal Requirements

Insert your content here.

17.2 Standards Compliance Requirements

Insert your content here.

18 Open Issues

Insert your content here.

19 Off-the-Shelf Solutions

19.1 Ready-Made Products

Insert your content here.

19.2 Reusable Components

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19.3 Products That Can Be Copied

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20 New Problems

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20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

Insert your content here.

20.5 Follow-Up Problems

Insert your content here.

21 Tasks

21.1 Project Planning

Insert your content here.

21.2 Planning of the Development Phases

Insert your content here.

22 Migration to the New Product

22.1 Requirements for Migration to the New Product

Insert your content here.

22.2 Data That Has to be Modified or Translated for the New System

Insert your content here.

23 Costs

Insert your content here.

24 User Documentation and Training

24.1 User Documentation Requirements

Insert your content here.

24.2 Training Requirements

Insert your content here.

25 Waiting Room

Insert your content here.

26 Ideas for Solution

Insert your content here.

Appendix — Reflection

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing "what you think the evaluator wants to hear."

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

1. What went well while writing this deliverable?
2. What pain points did you experience during this deliverable, and how did you resolve them?
3. How many of your requirements were inspired by speaking to your client(s) or their proxies (e.g. your peers, stakeholders, potential users)?
4. Which of the courses you have taken, or are currently taking, will help your team to be successful with your capstone project.
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.
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?