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| Project: Settlers of Catan | Fall 2017 |

Programmers Manual

Settlers of Catan

1. **Introduction**

The programmer’s manual provides a comprehensive set of requirements essential for understanding the structure and organization of the software herein referred to as “the game.” Settlers of Catan is a multiplayer strategy game where players build structures to leverage resources and gain victory points essential to winning the game.

* 1. **Scope of the Product**

Game scope provided as a press release statement. This scoping statement is commonly used at some technology companies including Amazon Inc. to provide a clear expectation of what a user can expect from the final product.

*Press Release:* December 2017, team Angry Penguins released the Settlers of Catan game for immediate play with up to 4 players. The very popular turn-based game is available on the web for compatible browsers, free to play, with anyone around the world!

Game features include:

* Web browser based graphical user interface (HTML)
* Network play for 3-4 human players
* Auto-generated game board
* Game follows base set of standard rules
* Game room selection

Game Requirements to run:

* A reliable internet connection
* A desktop computer browser (not mobile device ready)
* Chrome Browser version 62+ (note: other browsers such as Firefox may work but are not guaranteed)
  1. **Definitions, acronyms, and abbreviations**

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| Word/Acronym/Abbreviation | Definition |
| SOC | Settlers of Catan |
| Player | The user who has joined a game |
| Token | A game board piece that with a digit on it between 2 and 12. |
| Hex Tile | One of the 37 game board tiles. |

* 1. **References**

**Settlers of Catan is a copyrighted and trademarked by Catan GmbH.**

**More information about the game can be found at the following URL:**

[**https://www.catan.com/game/catan**](https://www.catan.com/game/catan)

**Settlers of Catan – Game Rules & Almanac (3-4 Players)**

[**https://www.catan.com/files/downloads/catan\_5th\_ed\_rules\_eng\_150303.pdf**](https://www.catan.com/files/downloads/catan_5th_ed_rules_eng_150303.pdf)

**Settlers of Catan – Turn Overview:**

[**https://www.catan.com/files/downloads/settlers\_of\_catan\_turn\_overview.pdf**](https://www.catan.com/files/downloads/settlers_of_catan_turn_overview.pdf)

1. **General Description**
   1. **Product Perspective**

Settlers of Catan was chosen given its worldwide popularity and familiarity to the software development team. This game is frequently played as a live in-home table top board game but few online gaming editions are known or available for play. Given the trend of online computing, there is a need for people to be able to connect socially with their friends and play games they love. Settlers of Catan fits as the type of game we thought others would enjoy playing online.

* 1. **Product Functions**

This software package provides an online capable web-based version of the Settlers of Catan game. The software allows up to four players to connect to a single instance of a game and play competitively remotely from any reliable internet connection. The game is playable from the Chrome web browser and does not require any specific hardware to play. The software represents a significant portion of the game functionality but is not comprehensive of all gameplay rules due to time limitations and development cost.

* 1. **User Characteristics**

This game is designed for casual gamers who have an interest in turn-based strategy games. Further, these users do not need to have expensive computing hardware and can play the game on most middle of the range computers. The game is designed to be playable from a web browser over a reliable internet connection.

A local developer version of the game is possible in lieu of having a web hosted computer. It is expected that the game will be reviewed from a standalone development machine.

* 1. **General Constraints**

This game is not tested with all web browsers and is therefore recommended to be used with Google’s Chrome version 62+ web browser. This game may function properly on other browsers but it has not been QA’d on browsers other than Chrome.

This game does not support users over unreliable or slow network conditions.

The game is expected to be hosted locally for testing and review. The game could be placed on an Amazon AWS web instance or Microsoft Azure if such resources are provided.

* 1. **Assumptions and Dependencies**

For local testing of the game, the requirements are as follows:

* Installation of Python 2.7 <https://www.python.org/dev/peps/pep-0373/>
* Installed JetBrains IDE PyCharm (free to UIS students and instructors). PyCharm is a commercial grade Python IDE. <https://www.jetbrains.com/pycharm/>
* Chrome web browser. <https://www.google.com/chrome>
* Download of source code from GitHub (some proficiency with GitHub preferred). <https://github.com/nadcock/CSC478-SOC-Game>
* Installation of a webserver: Pyramid <https://trypyramid.com/>. Additional details here: <https://docs.pylonsproject.org/projects/pyramid/en/latest/narr/install.html>

1. **Specific Requirements**

An enumeration of the functional game requirements is listed below. These are not in a specific order.

* 1. **Landing Page**
     1. A player can view a modern landing page with information on creating a game.
     2. A player can initiate a new game from the landing page.
     3. A player can initiate the Start of a Game
        + 1. A unique game ID is created for each new game
          2. A player provides a game name when starting the game.
  2. **Player Join a Game**
     1. A player can share game URL with other players to join a game.
     2. A unique player ID is created for each new player that has joined the game.
     3. The player will provide their name.
     4. The player will provide their age.
     5. The player is assigned a random color.
     6. The player is assigned resources to purchase two settlements at the start of the game.
     7. Up to 4 players can join a game.
     8. If more than 4 players join a game, the user is redirected to the landing page.
     9. A minimum of 3 players are required to start a game.
     10. A player is shown a “waiting” dialog with a notification of the number of players that have joined the game.
     11. When at least 3 players have joined a game, any players can start the game or wait for a 4th player to join.
     12. When players start the game, the game and all its components are initialized.
  3. **Game Resources**
     1. **There are 7 resource types used on the game board with following details:**
        + 1. Hills: resource type Brick. Color is red.
          2. Desert: no resource type. Color is light tan.
          3. Pasture: resource type Wool. Color is Light green.
          4. Forest: resource type Lumber. Color is dark green.
          5. Mountains: resource type: Ore. Color is light gray.
          6. Fields: resource type: grain. Color is light yellow.
          7. Water: no resource type. Color is light blue.
  4. **Game Board**
     1. The game board is made up of 37 hexagonal tiles
     2. The game board is organized in 7 rows of tiles. Each row contains:
        + 1. Row 1: 4 tiles
          2. Row 2: 5 tiles
          3. Row 3: 6 tiles
          4. Row 4: 7 tiles
          5. Row 5: 6 tiles
          6. Row 6: 5 tiles
          7. Row 7: 4 tiles
     3. Game board resources are randomly assigned to tiles (except outer water tiles).
     4. All perimeter tiles are water tiles.
     5. Settlements can be placed at the intersections of each tile.
     6. Tokens are assigned randomly to all land tiles.
        + 1. Tokens range between 2-12.
          2. Token numbers are displayed on tiles.
  5. **Game Board Page**
     1. Game board is rendered on screen.
     2. Player’s current score is shown as “Settlement Count”.
     3. Players current resources are shown:
        + 1. Brick, Wool, Ore, Grain, and Lumber
  6. **Settlement Purchase and Placement**
     1. An image of a house is used to represent a settlement on the game board.
     2. Settlement uses player color.
     3. The game board shows indicators of where settlements can be placed.
     4. Settlements can be placed anywhere there is an open location but not on an existing settlement.
     5. When the purchase settlement button is invoked:
        + 1. The cost of the settlement is deducted from the players current resources.
          2. The settlement must be placed next.
     6. Up to 10 settlements can be purchased per player.
  7. **Roll Dice**
     1. Ability to click ‘dice’ button and get random result back and shown.
     2. All players can see the dice roll results. (CUT)
     3. Results are shown as numbers.
     4. When dice is rolled, resources are granted to the player.
        + 1. Each player receives 1 resource for each settlement adjacent to the hex with the number rolled.
  8. **Player Turn Requirements**
     1. Player turns are ordered based on the order in which they join.
     2. Player board is updated to show placement of items by other players.
     3. When it is a player’s turn, the next action available is enabled for the player to click.
     4. When it is not a player’s turn, the player has no action buttons available.
     5. On my turn, the order is followed: roll dice; buy & place settlement, end turn.
     6. Buttons that are not enabled for the that stage of the turn sequence are disabled in the UI.
     7. On my turn, I roll the dice and am assigned resources:
        + 1. Get resources based on your dice roll and settlement placement.
          2. Resource are immediately available for use.
     8. On my turn, after I roll the dice, all other players resources are updated.
     9. When other users get resources based on your role, those players resources are updated to reflect the change.
  9. **Game End**
     1. Scores are tallied each round.
     2. First player to reach 10 points wins the game.
     3. Game notifies players when there is a winner.
     4. Game stops when 10 points reached. Players cannot continue game.
  10. **Trading**
      1. Ability to select Trade for Resource as a turn option after dice roll.
      2. Trade button is disabled unless a resource is tradable. 4 identical resources required for a trade.
      3. If trade of resource results in having adequate resources to purchase a settlement, the settlement button becomes activated.
      4. Selecting Trade button shows an interface that allows user to select a tradable resource for any resource.
      5. Tradable resource list only displays resources that are currently tradable.
      6. Trade action deducts 4 resources from the selected tradable resource, and adds 1 resource of the requested resource.
  11. **Turn Notification**
      1. On player turn, a ‘toast’ at the bottom of the screen appears to notify player.

1. **Design Documentation**

Key architectural design diagrams were created for modeling specific features of the product during development. These diagrams convey some of the specific user interaction that has been implemented in game.

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| **Diagram Type: Sequence** | **Web URL:** <https://go.gliffy.com/go/share/s7ectxr15hi8dg4jt3vh> |
| **Diagram Name:** Landing Page  **Diagram Purpose:** This diagram depicts the sequence of events that occur when a user initiates a new game. This is important for understand the general call flow from when the user (depicted) initiates a new game to when the game screen is drawn. | |
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| **Diagram Type:**  **Sequence** | **Web URL:** <https://go.gliffy.com/go/share/sc37ogsal6t86l3fmv2a> |
| **Diagram Name: Join Game**  **Diagram Purpose:** This diagramdepicts the sequence of events and call flow from when a user joins a game and is waiting for additional players to join. The Settlers of Catan game supports up to 4 players and requires a well-orchestrated series of events to handle when and how players can join.  Scroll down to view diagram. | |
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| **Diagram Type:**  **State Diagram** |  |
| **Diagram Name: Turn State Machine Diagram**  **Diagram Purpose:** This diagram shows the states for each player turn for the player model. Each player will loop waiting for their turn. When their turn starts, the player will roll dice then get options to purchase or trade resources to enhance their position in the game. | |
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1. **Source Code Documentation**

Source code has been documented with descriptions of what is implemented plus break out of which requirements have been implemented in which functions.

1. **Test Plan**

The test plan is organized following the same pattern as the requirements section. Some tests have been tested in the game UI, other tests were performed using direct API calls with the program named PostMan (see <https://www.getpostman.com/)>.

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| **#** | **Req. Tested** | **Rationale** | **Inputs** | **Expected Output** | **Passed?** |
| **Landing Page** | | | | | |
| 1 | 3.1.1 | User must be able to access the page that allows for them to start a game. | Game page URL | Landing page opens | Yes |
| 2 | 3.1.2  3.1.3.1.2 | User must be able to create a new game using the name they have chosen. | Create game button click and game name | New game window loads | Yes |
| 3 | 3.1.3.1.1 | A unique game ID is created to support more than one game at a time. Game ID can be passed to other players. | Create a new game | Unique game ID is created and visible in web URL. | Yes |
| **Player Joins a Game** | | | | | |
| 4 | 3.2.1 | Game URL grants another user ability to join a game – **2nd** player to join. | Game URL for a new game is opened in another machine or browser. Only 1 existing player joined to game. | Game join screen loads | Yes |
| 5 | 3.2.3 | Ensure each player is identifiable. | Player name in modal | Player name displayed on game page at game start. | Yes |
| 6 | 3.2.4 | Player age used for future game capabilities | Player age passed in via backend API.  Tested using PostMan. | Player age stored in backend. | Yes |
| 7 | 3.2.5 | Players are distinguished during game play based on their player color. | Player joins game | Unique color displayed on screen at game start. | Yes |
| 8 | 3.2.5 | Multiple players can be distinguished in game. | 4 Players join game | Each player has a unique color. | No  Bug #1 |
| 9 | 3.2.6 | Players need to place 2 settlements at start of game to gain further resources. | Player turn begins and has 2 of each resource. | * 2 brick * 2 wool * 2 ore * 2 grain * 2 lumber | Yes |
| 10 | 3.2.7 | Game supports up to 4 players | 4 players join (tested in unique browsers) | 4 players in game | No  Bug #1 |
| 11 | 3.2.8 | If a 5th player tries to join the game BEFORE it has started, that player is notified with a message and returned to the landing page | Join existing un-started game with 4 existing (signed-in) players | Game full modal shown. Redirect to landing page | Yes |
| 12 | 3.2.8 | If a player tries to join a game AFTER the game has begun, they are notified and directed to the landing page. | Join existing started game | Game modal shown. User redirected to landing page. | Yes |
| 13 | 3.2.9 | Game can begin after 3rd player has joined game. | Create game.  Have 3 players join | Game modal allows user to start game.  Game modal shows 3rd player has joined. | Yes |
| 14 | 3.2.10 | Players are shown waiting dialog that increments as new players join. | Have 1 player join a game.  Have a 2nd player join a game. | “Waiting for players” dialog shown.  Player count increments by +1 when a player joins. | Yes |
| 15 | 3.2.11 | Any player can start game when minimum 3 players have joined. | 3 players join a game. Player 2 or 3 used to start game. | Game starts for all players. | Yes |
| 16 | 3.2.12  3.5.1  3.5.2  3.5.3 | Game board screen properly initializes for all players. | 3 players join a game. | Game board show.  Player score show.  Player resources show.  Game controls show. | Yes |
| **Game Resources** | | | | | |
| 17 | 3.3.\* | Game resources are presented in the expected color. | Load game board | Game board loads with 7 color board. Exact board color definitions in board\_builder.js | Yes |
| **Game Board** | | | | | |
| 18 | 3.4.1 | Game board contains right number of pieces. | Load game board | 37 unique hexagonal pieces shown | Yes |
| 19 | 3.4.2.\* | Game board layout is correct | Load game board | Board layout is comprised of 7 rows.  Row 1 has 4 tiles  Row 2 has 5 tiles  Row 3 has 6 tiles  Row 4 has 7 tiles  Row 5 has 6 tiles  Row 6 has 5 tiles  Row 7 has 4 tiles | Yes |
| 20 | 3.4.3 | Land resources are randomly assigned so new games are unique. | Load game board 3x | Screen shots of board shows unique land resource layouts | Yes |
| 21 | 3.4.4 | Water resources are assigned around perimeter. | Load game board | Water resources circle perimeter of game board. No water resources within game board. 18 water tiles. | Yes |
| 22 | 3.4.5 | Settlement placement can occur at the edges of any of the land tiles. | Load game board.  Place a settlement on an open game board ‘dot’. | Settlement can be placed on game board dot. | Yes |
| 23 | 3.4.5  3.6.4 | Settlement placement **cannot** occur over the top of an existing settlement. | Load game board.  Place settlement 1 on board.  Attempt to place settlement 2 over top of settlement 1. | Settlement 2 does not place. | Yes |
| 24 | 3.4.6 | Roll die tokens are randomly assigned to hex tiles. | Load new game board 1.  Load new game board 2. | Token numbers appear randomized. | Yes |
| 25 | 3.4.6.1.1 | Tokens represent numbers found on two six-sided dice. | Load new game board. | Token numbers are between 2 and 12. | Yes |
| **Settlement Operations** | | | | | |
| 26 | 3.6.1 | Settlement icon used is distinguishable | Load new game with 3 players.  Roll dice  Buy and place a settlement | House shaped icon appears | Yes |
| 27 | 3.6.2 | Placed settlements uses players color. | Load new game with 3 players.  Buy and place settlements from each of the players. | Settlement icons are player color. Matches player name. | Yes |
| 28 | 3.6.3 | Settlement placement locations are visible. | Load new game with 3 players.  Buy a settlement but don’t place it. | Settlement locations ‘pulse’ | Yes |
| 29 | 3.6.5 | The cost of the settlement is deducted from the total resources. | Buy 1 settlement | 1 resource is deducted from: brick, wool, grain, and lumber. | Yes |
| 30 | 3.6.5 | Settlements cannot be placed when not enough resources. | Buy settlements until out of resources. | Unable to buy more settlements than resources permit. | Yes |
| 31 | 3.6.6 | Up to 10 settlements can be purchased. | Buy settlements and take turns until maxed out. | 10 settlements can be placed per individual player. | Yes |
| **Dice Operations** | | | | | |
| 32 | 3.7.1 | Player can roll dice | Click roll dice button on player turn | Random numbers between 1-6 are generated on 2 dice. | Yes |
| 33 | 3.7.2 | All players can see all dice roll results. | Feature CUT |  | N/A |
| 34 | 3.7.4 | Dice roll grants resources to all players. | Join minimum 3 players to game.  Place settlements.  Roll dice and document dice rolls. | Dice rolls that match token digits and touching a settlement receives 1 resource point on players turn. | Yes |
| **Player Turns** | | | | | |
| 35 | 3.8.2 | Player turn order is by join order | Join 3 players to a game | Player 1 is the player who joined first. | Yes |
| 36 | 3.8.3 | Player actions are lit up in order. Cannot be invoked out of order. | 3 players join a game.  Step through game play options. | Game play order is:   1. Roll Dice 2. Buy Settlement 3. End turn   Buy settlement can be clicked until the player is out of resources. | Yes |
| 37 | 3.8.4  3.8.6 | When player waiting for turn | 3 players join and start game.  View player game that does not have turn. | Player has no clickable action buttons available. | Yes |
| 38 | 3.8.6 | Buttons not for specific stage of game are disabled. | 3 players join game. | Player 1 Roll Dice button active while buy Settlement and End turn disabled. | Yes |
| 39 | 3.8.9 | When another player rolls a dice, my player gets resource points as well. | Play several rounds of the game and count rolls and resource matches. | Resources acquired from other player rolls are attributed to all players that have settlements on resource hex tiles with matching token. | Yes |
| **Player Wins Game** | | | | | |
| 40 | 3.9.1 | Scores are counted each round. | Play several rounds of game. | Score reflects number of settlements placed per player. | Yes |
| 41 | 3.9.2  3.9.3 | Win game case | First player to reach 10 points wins game (may take 30+ minutes) | Game ends with notification to all players | Yes |
| 42 | 3.9.4 | Game stops at win | Play game until player reaches 10 points (may take 30+ minutes) | Game stops after notifying players of win. Game does not continue. | Yes |
| **Trading** | | | | | |
| 43 | 3.10.1 | Player has ability to trade. | Play rounds of game till 4 of one resource is available. | Trade button should become available for resource that is 4 or greater in quantity. | Yes |
| 44 | 3.10.2 | Player does not have ability to trade when they don’t have enough resources. | Play rounds of game to accrue between 1-3 of some resource types. | Trade button disabled. | Yes |
| 45 | 3.10.3 | Post trade, user with adequate resources can buy a settlement. | Play and trade till adequate resources to buy settlement. | Settlement button activated after trade. | Yes |
| 46 | 3.10.4 | Trade interface | Open trade interface. | Trade interface shows all tradable options (from and to). | Yes |
| 47 | 3.10.5 | Limited trade options | Open trade interface when 4+ of 2 resource types. | 2 resource types shown as trade from. | Yes |
| 48 | 3.10.6 | Player successfully makes a trade. | Trade 4 of 1 resource for another resource. | 1 resource successfully traded. 4 of original resource subtracted from available. | Yes |
| Notifications | | | | | |
| 49 | 3.11.1 | On player turn, a notification shows. | Start 3 player game. Take turns. | A ‘toast’ appears on screen to notify player it is their turn. | Yes |

1. **Known Bugs**

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| # | Bug | Impact |
| 1 | 4 players do not show properly in game player list. Shows 3 players when 4 are active in game. | Only 3 players can properly play the game. |
| 2 | Token #7 and Desert tile is always the last token | Minimal. Reduces randomness. |
| 3 | Waiting for Players Modal does not appear if user “refreshes” the browser. | Minimal. |