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General Overview

If you don't know the rules of the game yet, you’ll want to become familiar with them in order to implement the project. You can’t program what you don’t understand. You can find the rules of the game [here](#).

There are four main pages for the game: login page, game hub page, game initialization page, and gameplay page.
You will need to implement the controllers for each page. Later you will do the server logic as well.
Since this game is web-based, we cannot give you a functioning demo; to mitigate this, we provide this spec to help you know how everything needs to work.

The first section of this spec discusses the main game flow and the layout of the main page. The following section describes the purpose and functionality of each view on the main page.
Main Game Board

The main game board can be split into several major functional views. These views are:
1. Chat and game history (log)
2. Map
3. Point display
4. Resource bar
5. Turn tracker and game state button
6. Domestic trading
7. Maritime trading

There are also several additional views necessary for gameplay which are implemented using modal overlays. The main overlay interfaces include:
1. Rolling dice
2. Discarding cards
3. Development cards (see the game rules for details about development cards).
4. Map placement
5. Robbing

Two pages use the main game layout: the game play page and the initialization page. The initialization page is a slightly reduced version of the main board, and is used solely for the first two rounds of the game (see Game Flow: Initialization).
Game Flow

Login Page (login.html)

The login should reject invalid credentials by bringing up an error overlay.

Registering a new user should reject the registration if the username is fewer than 3 or greater than seven characters, if the password is less than 5 characters long or is not made of allowed characters (alphanumerics, underscores, hyphens, or if the password verification entry doesn’t match the original.

On successful login or registration, the browser redirects to the game hub page, where a player can create or join a game.

Game Hub (joinGame.html)
The game hub displays a list of the current available games and the players connected with it. If a game is available to join (you are already connected to it or it needs more players), the “join” button should display, but not otherwise. You have the option of creating a new game by pressing the “create” button.
Pressing the “create new game” button will bring up an overlay that allows you to name it and choose settings for initializing the game board. These are optional random settings. If a random setting is not selected, the game should initialize with the default settings (see the official game rules).

Logged in as Sam, you have the option of rejoining a saved game or joining a new one.

Pressing the “create” button should create a game, which should then show up in the game hub as a new game with one player.

Then selecting a game to join brings up a color chooser, with unavailable colors greyed out. Select a color by clicking on it, and then join the game by intuitively pressing the “join game” button. Players should be allowed to change their colors if re-joining a game.
Selecting a color will turn the button text white. On pressing the join button, the page should redirect to the “wait” page until the four required players have joined.

**Wait Page (playerWaiting.html)**

This page shows the name and color of each player that has joined the game. This dynamically updates as players join, adding the player and updating the title to display how many remain. Pressing the “Add a computer player” button adds a computer player to the game, and will update the view to reflect the change. As soon as all four player positions are filled, this page redirects to the game initialization round page to begin the game.

All games have four players; a game cannot proceed until four have joined. This appears after a player has joined a game either by creating a new one or joining an existing one.
Initialization (setup.html)
(See the map section for visuals)

The game initialization round flows as described in the game rules. It lasts for two rounds, then redirects to the main game play page.

These roads and settlements do not cost anything (the player’s resources shouldn’t change from zero).

On a player’s turn, the “place road” overlay should appear. When a player places a road, it should close the modal and update the map. Then the “place settlement” overlay should appear; when placed, the overlay should disappear and the map should update. Then the player’s turn should end. These should happen automatically.

When it’s not a player’s turn, the game board should be in its disabled state, with no functionality.

At the end of the initialization round, the page should redirect to the game play page, and the game begins by rolling the dice.

Example players:

Sam 2  Brooke 2  Pete 2  Mark 2

Sam goes first, then Brooke, then Pete, then Mark. Once Mark has placed his first road and settlement, his turn repeats, and it continues in reverse order (Pete, Brooke, Sam). When Sam has placed his second settlement the game redirects to the game play page; then the game begins with Sam rolling the dice.
Game Play (catan.html)
After all the game setup, the remainder of the game takes place in the main game page. Each turn begins by rolling the dice, after which the current player can choose to buy, build, trade, use a card, or end his turn.

The following sections describe the flow of individual parts of the game.
**Game Board Overview**

*Map*
The main game map is a static view that displays the current state of the board. It should correctly display each hex’s type (water, desert, or specific resource) and the value of each hex (port type or roll value). It should also show the correct placement and color for each player’s pieces.

During the course of the game, often you need to add things or move things on the map. To this end, there is a map overlay which should appear any time something has to change with respect to the map. These actions include placing roads, settlements, or cities, and moving the robber.

![Map Overlay](image)

See the document about hexagonal grids for more information about the hexagonal coordinate system of the map.

*Robbing*
This overlay appears automatically after a seven is rolled. Hovering over a hex should indicate whether that is a valid robber location. The robber may not be placed in the previous robber location or on a water hex. Clicking on the map should place the robber if possible, close the map overlay, and bring up the robber overlay. If you cannot place the robber in a given location, clicking there should do nothing.

![Robber Overlay](image)

Invalid robber move

Moving from the wheat hex to the forest hex

The rob overlay displays a button for each player available to rob based on number of cards and location. If a player does not have a settlement or city on the robber hex, they should not be included.
Additionally, players with no cards and the current player should not be included. If there are no players available to rob, the overlay should display a button indicating that no players are available.

Each button should display the player’s name and number of cards. Clicking on a player’s display button should close the modal and rob the player of one random card. If there are no players to rob, pressing the button should simply close the modal.

Building
The building overlay appears after clicking on the settlement, city, or road buttons on the resource bar. Hovering over a location should indicate whether it is valid. Clicking on the map should place the piece if possible and close the modal, correctly updating the main map view for all players. If a move is not valid, clicking should do nothing.

Settlements and Cities
Placing a settlement or city gives a player access to the resources of each adjoining hex, and increments the player’s points. Settlements must be placed two or more roads segments away from each other, and must connect to one or more roads belonging to the player. Cities may only replace existing settlements.

Roads
Roads may only be placed on edges between hexes. Each must connect to another road belonging to the player. The only exception to this is during the initialization round, when placing the first two roads of
the game. When a player places the road, the game calculates who has the longest road—if the player does, he receives the accompanying award (see Turn Tracker).

Once a piece has been placed, the map should update correctly.
**Turn Tracker**

The Turn Tracker displays information about the players and the state of the game. It highlights the current player, and displays the color, name, and total points for each player. It also displays the awards a player has earned.

When the current player changes, the highlight should update appropriately. In the image above, it is Sam’s turn—at the end of Sam’s turn, the highlight should move from Sam to Brooke.

**Awards**

![Largest Army](image1.png) ![Longest Road](image2.png)

Longest road is awarded to the first player to build a road five segments long; largest army is given to the first player to play three soldier cards. Each award is passed on as players build longer roads and larger armies.

When a player earns an award, the turn tracker should update the player information by displaying the award and the new point amount for the player (and removing the award display from an opposing player if necessary).

**Game State Button**

There are several states the game can be in: playing, discarding, rolling, robbing, and the first two rounds (see [initialization](#)). The game state button is what a player uses to finish his turn. When a player is in a non-play state (waiting for his turn, rolling the dice, robbing, discarding), the button should display a message (“Waiting for Other Players”) to indicate that he cannot play yet. A player can only finish a turn after he has rolled (and discarded, if needed), so the button should be disabled until that point.

*In the initialization round, a player must place a road and settlement before being able to finish a turn.*
When enabled, the button should display with the player’s color. Clicking the button should advance the player turn to the next player and disable the button (greyed out and unable to click on it).

Points
The point display is a read-only display that updates with the number of points a player has earned. There are 10 circles to represent total points required to win. Stars represent the number of points a player has; empty circles are the number of points remaining. This should update correctly anytime a player earns or loses points.
Roll Interface

At the beginning of a turn, the roll overlay should appear on the current player’s screen. It displays a countdown which defines when to automatically roll. When the countdown times out or the “Roll” button is clicked, the overlay should disappear and the player’s roll amount is calculated. Then the “Roll Result” overlay should appear and display the amount rolled.

Clicking “Okay” should close the modal and allow the game to proceed.

Rolling a Seven
When a player rolls a seven, each player may need to discard cards. The discard overlay should appear for any player who needs to discard. The button displays the current amount the player has set to discard, out of the total needed, and should be disabled except when a player has set the correct amount.
A player sets cards to discard by clicking the arrow buttons to increase or decrease amounts. The buttons should be disabled when a player can give no more of that resource.

When a player has set the correct number of resources, all the “up” buttons should disappear and the discard button should enable. Decreasing any amount should then disable the discard button and let a player adjust amounts again.
In addition, the current player must then move the robber after everyone has discarded, and steals a card from a player. See the Map: Robbing section for details.
Resource Bar

The materials a player has access to are displayed in the resource bar. There are four different kinds of materials: resources, buyables, development cards, and the soldier display. Resources and the soldier display are read-only displays; buyables and development cards are clickable images that should enable or disable depending on whether the player can use them at that time.

**Resources** are the materials a player can use to buy things. Each of these is a static image with the total quantity that a player has earned. They should update correctly after trades, buying, rolling, robbing; anytime the player’s resources change.

**Buyables** are the materials that a player can buy: roads, settlements, cities, and development cards.

These are clickable images that should disable when a player does not have the required resources or when it is not their turn. They should enable with the appropriate action if a player can buy it. Clicking on a road, settlement, or city should bring up the map overlay and allow you to place the material on the map, or cancel the move. Clicking the card button brings up a “buy card” overlay.

No amount is displayed by the buy card button. The player’s remaining materials display by each other button.

**The development card button** brings up the development card overlay. It should be enabled during your turn, and disabled when not your turn.

-see more details in the following section.

**The soldier display** is a static image that shows the size of your army (the number of soldier cards you’ve played).

-see more details in the following section.
Development Cards

When you click on the “buy card” button in the resource bar, it should bring up the “buy card” overlay, which is shown below. If you click the “Buy Card” button in the overlay, a card should be purchased from the deck, and the player’s resources reduced accordingly. If you click “No thanks!” the buy card operation should be canceled. The “buy card” overlay should close when you click either button.

![Buy Development Card Overlay](image1.png)

When you click on the “development card” button in the resource bar, it should bring up the development card overlay, which displays all the cards you’ve bought but not used. Hovering over a card will show its description underneath the cards.

Cards are enabled when you can use them. Monument cards can be used immediately; all other cards cannot be used until the following round. You can only play one card per round, so when you’ve played one, all other cards should disable (faded). Choosing a card to play closes the card modal and brings up the appropriate modal to do the card’s action (or just gives you a point in the case of monument cards).

![Development Cards Overlay](image2.png)
The soldier card acts like a robber (see the map section), and increases the size of your army by one. The road building card lets you place two roads at once or cancel the action. Both use the map overlay.

The year of plenty and monopoly cards each let you choose resources from selectors, and you can either use the card and gain the resources or cancel the action. Using the card closes the modal.
Domestic Trade

Domestic trades are trades between players. To set them up, players use the chat system to haggle then use the trade interface to follow through. A player may only send trade offers on his turn, and only receives offers when not his turn.

After discussing the terms of the trade, the player can go to the domestic trade tab in the main play area to create a trade offer. If it’s not the player’s turn, the display will look like this:

Otherwise, the tab should display options for trading, and he should be able to set a trade as follows:
Choose what resources to trade, and in which direction they are going (sending or receiving), and then adjust the amounts. When available resources have maxed out, the arrow buttons disappear.

**Empty State**

Selecting “none” will clear the amount changer. This is the empty state for a resource.

**Sending**

Selecting “send” brings up the amount changer. 0 is the start value. Increasing is enabled if the amount is less than the current player’s total. Decreasing is enabled if the amount is greater than 0.

**Receiving**

Selecting “receive” brings up the amount changer. 0 is the start value. Increasing is always enabled (the player can request as much as he wants). Decreasing is enabled if the amount is greater than 0.
You then choose a person to trade with from your opponents. Once the trade is set and a player is selected, the trade button should enable. The button should update with the appropriate message.

When you’ve sent the trade offer by clicking the button, you have to wait for the other player to accept or reject your offer before proceeding (otherwise you might try to use the resources you’re offering).

Meanwhile, the other player will have the opportunity to accept or reject the trade.
They may not have the resources to trade, in which case the overlay should disable the accept button with a “can’t accept” message.

When the player accepts or rejects the trade, the overlays should disappear and gameplay can proceed. Resources should update correctly for both players and the trade display should reset to show an empty trade (no resources or players set; see above image), and buttons should enable or disable to reflect the player’s updated resources.
**Maritime Trade**

Maritime trade is between a player and the bank. If you are on a special sea port, you can trade reduced amounts of a resource. Ratios are always X to 1 (You give X, you get 1).

Any player can do a 4:1 trade of any kind of resource. Building on a 3:1 port lets you trade any resource. Building on a 2:1 port requires you to give up a certain kind of resource.

You may only do a maritime trade on your turn, and if you have enough resources. If you can’t trade, the display should look like one of the following (disabled buttons, appropriate message).

If you have the resources and the ports, you can do a maritime trade. Each resource icon is a button. When you have enough of a resource, the button enables and you can select it.

Selecting a resource should hide the other resources and enable an undo option with the port amount displayed. The undo option should unset the resource you are giving or receiving. The receive options appear underneath.
The port options should override each other in favor of the least amount—in other words, if you have a 3:1 general port and a 2:1 ore port, all of the resources except ore should have “3” display. Ore should have “2” display.

Choosing an option from the second set allows you to make the trade:

On clicking the trade button the player’s resources should update and the trade display should reset (nothing selected). The buttons should be enabled or disabled to reflect updated resource amounts.

Unsetting a resource should show all options from the current level. Unsetting a “give” resource if both are set should also unset the “receive” resource--hitting undo on the top if both top and bottom are displayed should make the bottom disappear and the top display all options. Unsetting a “receive” option should not affect the “give” option--hitting undo on the bottom should only affect the bottom display.
Chat/Game Log

The game log is a read-only log which displays what’s happened during the game. This includes cards being played, trades being accepted, what a player rolls, and robber actions. Each log entry is colored by whose turn it is.

The Chat history is just like the game history, except it has an interactive element. Each entry is colored by the player who sent it. When you hit the “Send” button, the message is sent and displayed for everyone.
End of Game

At the end of the game, one of two overlays should appear for each player. Clicking the button on either one should redirect you to the game hub, where you can join a new game.
Tips and Hints

As the controllers communicate with the views, you have to pass in String references to define which object you are updating. To minimize headaches, we have provided a file (StudentDefinitions.js) which has the String definitions that you will need to use.

We have also created a references page to help you navigate through the project. Run the server using the ant command, and open “localhost:8081” in the browser, and it will take you to the references page.

Javascript is a scripted language, which means that as you write it, errors will not show up before you try to run it. As you develop your controllers, bear in mind that views are dependent on the information they receive from the server. If on loading the page there are views that go missing and you don’t know why, most likely there is a bug in the controller code that is preventing the code from running properly. If there is an error, bringing up the browser console will display the error and where to find it. You can bring up the console using the Ctrl-Shift-J command.