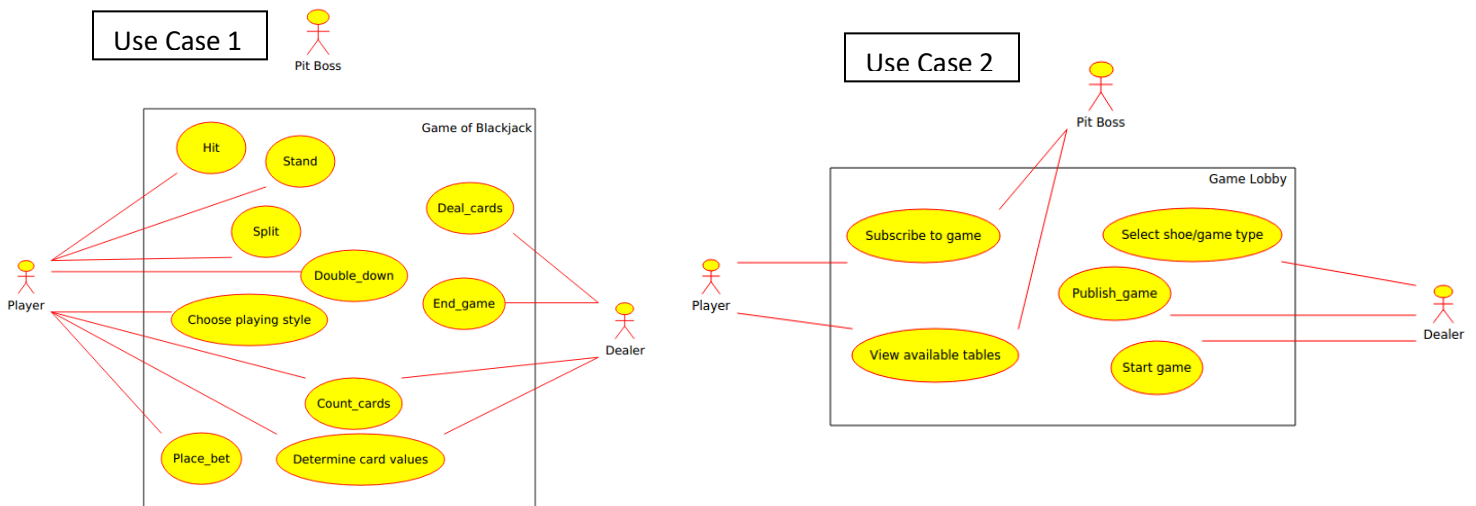


Requirements Specification

Introduction

This system will allow users to play blackjack over a network. There will be a Dealer instance that will be responsible for hosting a game that Players will be allowed to join. Up to 7 players will be allowed to play the game per dealer. The system will communicate over a network connection using Opensplice middleware as the conduit. Players will all start off with \$500 when joining and will be able to play until they leave or run out of necessary funds to play. The Player will be given the option of manual play, or automatic play where 3 different game play strategies will be available to choose from. Once the game has started, the dealer instance will be automatic with no user input from the dealer instance. The dealer instance will be responsible for game states as well as dealing the cards to the Players. The dealer will provide feedback to the Players based on basic blackjack strategy and the current running count at the table. All users will have a running table count value available. The game instance will be available until the dealer of that game leaves.

Use Cases



Use Case ID:	1		
Use Case Name:	Play Blackjack		
Created By:	MT	Last Updated By:	MT

Date Created:	2/25/18	Date Last Updated:	2/25/18
Actors:	Player, Dealer, Pit Boss		
Description:	Shows the actions that can be taken by each user during an active game of UberCasino		
Preconditions:	<p>The dealer has successfully published an active game.</p> <p>At least one player has broadcast a join request that has been accepted by the dealer.</p>		
Postconditions:	The dealer must complete the current hand before terminating the game session.		
Normal Flow:	Once in a game, the dealer will deal cards to each active player that has placed a bet. Each player will then decide, based off their cards, whether to hit, stand, split, or double down. Each player has the ability to change their player style in between hands.		
Alternative Flows:	If any player takes longer than 7 seconds to make a decision, they are kicked out of the game.		
Exceptions:	A player's turn is over when their cards combined face value exceeds 21.		
Frequency of Use:	For the length of any active game		
Business Rules:	<p>Dealer can only end the game when a hand is complete.</p> <p>Players can only change playing style between hands.</p> <p>Player can only split if they have two cards of the same face value.</p> <p>Doubling down will result in the player doubling their bet and only receiving one additional card.</p>		
Special Requirements:			
Assumptions:	All three actors were able to successfully connect to and join a game		
Notes and Issues:			

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Use Case ID:	2		
Use Case Name:	Join Game		
Created By:	MT	Last Updated By:	MT
Date Created:	2/25/18	Date Last Updated:	2/25/18
Actors:	Player, Dealer, Pit Boss		
Description:	Shows the actions taken in order to join and start a game in the UberCasino		
Preconditions:	Program boots successfully and connects to OpenSlice server		
Postconditions:	At least one player can connect the to dealer program and the dealer starts the game.		
Normal Flow:	<p>The dealer will publish that it is hosting a game.</p> <p>The Player and Pit Boss see available dealers and subscribe to the one that they choose. Once enough players have joined the game the dealer can start the game.</p>		
Alternative Flows:	The programs are incompatible with each other due to inconsistent use of the open slice IDL file and connection is refused.		
Exceptions:	A user is unable to connect to the open slice server, therefore unable to view active games or players.		
Frequency of Use:	Used at the launch of each program, and after a game has ended, assuming the user does not exit the program.		
Business Rules:	A Player must request, from a dealer, to join a game, and that dealer must accept that request.		

	A dealer will not accept a request to join a game if the current player count is 7 or higher.
Special Requirements:	
Assumptions:	Users are able to connect to the Open Splice server for the game.
Notes and Issues:	

Requirements

Date Added	Req_ID	Description	Last Modified	Assigned	Source	F/NF
2/17/18	1	The system will be written in C++11 programming language	2/24/18		From Requirements Doc	NF
2/17/18	2	The system will use the fltk library for implementation of GUI	2/24/18		From Requirements Doc	NF
2/17/18	3	This program will cleanly compile with the use of the -Wall flag	2/24/18		From Requirements Doc	NF
2/17/18	4	The program shall complete one full game of blackjack (defined as 8 decks)	2/24/18	Dealer/Player	From Requirements Doc	
2/17/18	5	The program shall have a Basic Strategy Lookup table	2/24/18	Dealer/Player	From Requirements Doc	NF
2/17/18	6	Each game instance shall allow one to seven players and one dealer to play a game of blackjack	2/24/18	Dealer/Player	From Requirements Doc	F
2/17/18	7	The system shall be implemented with 3 separate programs, a Dealer, a Pitboss, and a Player	2/24/18	Dealer/Player	From Requirements Doc	F

2/17/18	8	The communication between programs shall only be implemented using the pub/sub middleware package Opensplice	2/24/18	Dealer/Player	From Requirements Doc	F
2/17/18	9	This system shall communicate in accordance with one IDL file used by all instances	2/24/18	Dealer/Player	From Requirements Doc	F
2/17/18	10	The Player shall begin the game with a balance of \$500USD to be used for bets	2/24/18	Player	From Requirements Doc	F
2/17/18	11	The Player shall be allowed to play a game until their balance is \$0 or their balance less than the min bet	2/24/18	Player	Derived from Requirements	F
2/17/18	12	A Player's balance shall not at any point be below \$0, or negative	2/24/18	Player	Derived from Requirements	F
2/17/18	13	The Dealer instance shall support 3 different kinds of shoes: Test, Infinite, and 8 Deck	2/24/18	Dealer	Derived from Requirements	F
2/17/18	14	The Test Shoe shall support 10 pre-defined scenarios and will act as a specific test sequence designed for system verification.	2/24/18	Dealer	Derived from Requirements	F
2/17/18	15	Each player shall receive the same card in Test mode	2/24/18	Dealer	Derived from Requirements	F
2/17/18	16	The Infinite Shoe shall implement a shoe where cards are dealt solely based upon fixed card percentages	2/24/18	Dealer	Derived from Requirements	F
2/17/18	17	The 8-Deck Shoe shall consist of 8 standard 52 card decks	2/24/18	Dealer	Derived from Requirements	F

2/17/18	18	The Dealer GUI shall show the dealer's dealt cards face up, each players dealt cards, the point value of each players hand in USD, the current count at the table, and the expected action from each player following basic strategy	2/24/18	Dealer	Derived from Requirements	F
2/17/18	19	The Dealer shall check and ensure that players follow the rules of Blackjack.	2/24/18	Dealer	From Requirements Doc	F
2/17/18	20	The Dealer shall not allow any Players to split cards unless the two cards being split are of the same card value	2/24/18	Dealer/Player	Derived	
2/17/18	21	The Dealer shall not allow the Player to take any further action once they have been dealt a Blackjack	2/24/18	Dealer	Derived	F
2/17/18	22	The Player program shall allow 5 strategies of play: Manual, By the Book, Conservative, Reckless, and Card Counting	2/24/18	Player	Derived from Requirements	F
2/17/18	23	Manual strategy for the player shall let the user make all decisions of play via the GUI interactions	2/24/18	Player	Derived from Requirements	F
2/17/18	24	By the Book strategy for the Player shall automatically make decisions and actions in the game for the user following basic blackjack strategy	2/24/18	Player	Derived from Requirements	F
2/17/18	25	Conservative strategy for the Player shall automatically make decisions and actions in the game for the user where it never takes a card when the Player's current hand value is 12 or more, and takes a card otherwise	2/24/18	Player	Derived from Requirements	F
2/17/18	26	Reckless strategy for the Player shall automatically make decisions and actions in the game for the user where it takes a card when the Player's current hand value is 20 or less	2/24/18	Player	Derived from Requirements	F
2/17/18	27	Card Counting Strategy for the Player shall automatically make decisions and actions in the game for the user where a card counting strategy chosen by the specific user is implemented	2/24/18	Player	Derived from Requirements	F
2/17/18	28	The Player GUI shall display the Dealer's cards, the player's cards, and the player's own financial situation	2/24/18	Player	From Requirements	F

2/17/18	29	The minimum table bet allowed to be placed by the Player shall be \$5USD	2/24/18	Player	From Discussion Questions	F
2/17/18	30	The Dealer shall publish the type of shoe being used to all Players at the table	2/24/18	Dealer	From Discussion Questions	F
2/17/18	31	The Player shall be display the cards of all other active players, the dealer, as well as their own.	2/24/18	Player	From Discussion Questions	F
2/17/18	32	All instances of the table shall display the current card count of the table.	2/24/18	Dealer/Player	From Discussion Questions	F
2/17/18	33	The balances in the game will be represented in USD.	2/24/18	Dealer/Player	From Discussion Questions	NF
2/17/18	34	The Dealer shall only allow the Player to split cards of the same value a maximum of 2 times per hand.	2/24/18	Dealer	From Discussion Questions	F
2/17/18	35	The Player shall be allowed to leave the game when a hand is done being dealt.	2/24/18	Player	From Discussion Questions	F
2/17/18	36	The Dealer shall allow the Player currently being dealt a maximum of 7 seconds from the time their turn begins to make a decision before removing them from the game and moving on to the next player.	2/24/18	Dealer/Player	From Discussion Questions	F
2/17/18	37	The Player shall place wagers in fixed increments of \$1USD	2/24/18	Player	From Discussion Questions	F
2/17/18	38	The Player shall be allowed to place a wager up to the amount of their current balance.	2/24/18	Player	From Discus	F

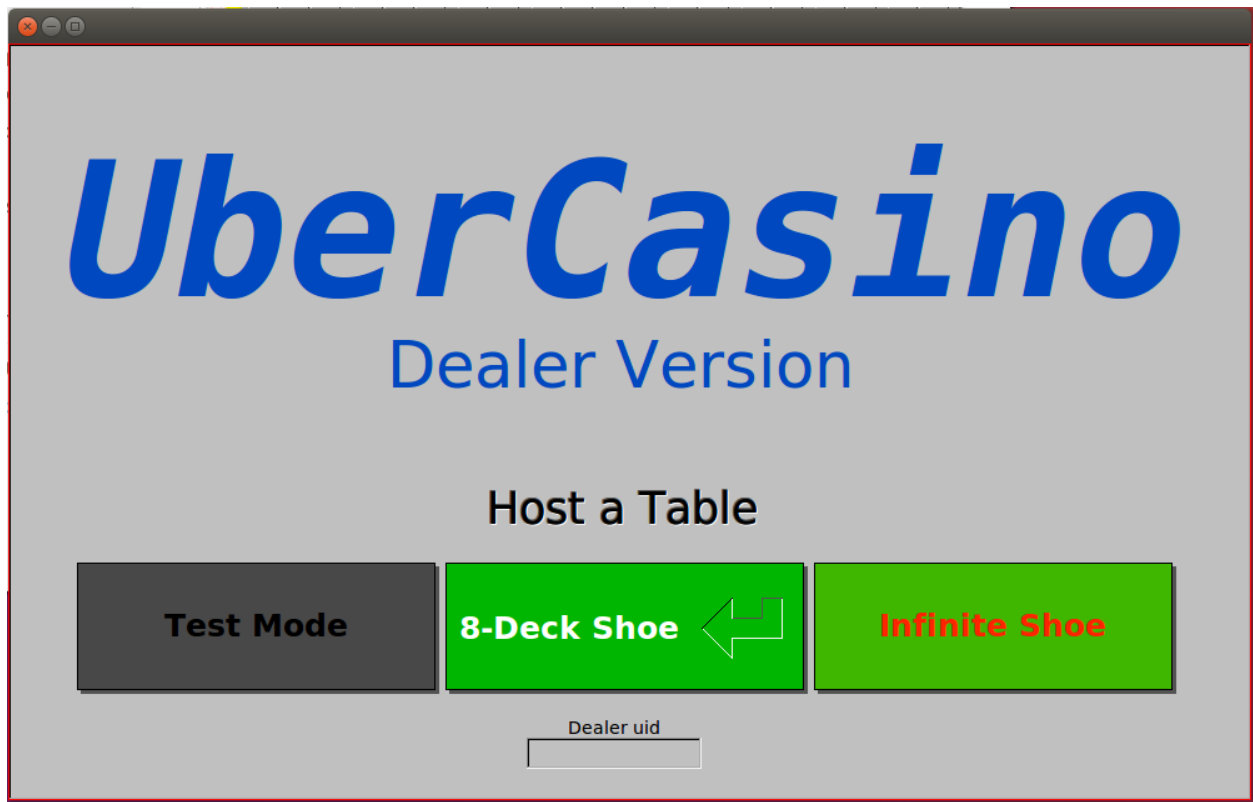
					sion Questi ons	
2/17/18	39	The standard 52 card deck shall consist of 4 Suits (Hearts, Clubs, Diamonds, Spades) that will be evenly distributed, and each suit will have one card for each value of 2-10, jack, king, queen, and ace.	2/24/18	Dealer/ Player	From Video	NF
2/17/18	40	The cards shall be represented by the numbers...(Question: What value are we assigning to each card and face card?)	2/24/18	Dealer/ Player	From Video	F
2/24/18	41	A card's value during the game will be equal to: 2-10 will hold their face value, face cards will be worth 10, and aces will be worth 1 or 11 based on what benefits the Player	2/24/18	Dealer/ Player	From Video	NF
2/24/18	42	The Dealer shall not allow the Player to change the amount of their initial bet once the hand has been dealt.	2/24/18	Dealer	From Video	F
2/24/18	43	The Dealer shall deal 2 cards to each player to start the hand	2/24/18	Dealer	From Video	F
2/24/18	44	The Dealer shall deal themselves 1 card face up to be seen by the Players, and 1 card face down	2/24/18	Dealer	From Video	F
2/24/18	45	Only the Dealer shall be allowed to change the face up boolean attribute during a game	2/24/18	Dealer	Derive d	F
2/24/18	46	The game is won by the Player if the combined value of their cards is higher than the combined value of the dealers cards, given the Players value is not higher than 21 and the Dealer's value has either exceeded 21 or is greater than 16.	2/24/18	Player	Derive d	F
2/24/18	47	When any player wins, the player shall receive an addition to their balance in the amount equal to their bet, and receive their bet back into their balance excluding when a player wins with Blackjack	2/24/18	Player	Derive d	F
2/24/18	48	When the Player receives Blackjack, which is their 2 first cards being valued at 21, they shall receive an addition to their balance in the amount of 150% their bet, as well as their bet back in their balance immediately as long as the Dealer's value is not also 21.	2/24/18	Player	Derive d	F
2/24/18	49	When the hand is over and the Dealer's cards value is equal to the Player's cards value, the Player will receive their bet back in their balance with not winning. This is considered a push.	2/24/18	Player	Derive d	F
2/24/18	50	When the Player's combined card value exceeds 21, they shall automatically lose their bet and their cards shall be removed from the game before the Dealer moves on to the next Player or ends the hand.	2/24/18	Dealer/ Player	From Video	F
2/24/18	51	The Dealer shall deal cards to the current Player until either the value of their hand exceeds 21 or they choose to stand.	2/24/18	Dealer	Derive d	F

2/24/18	52	The Dealer shall deal cards to the rightmost Player first, dealing each player 1 card before dealing the second card.	2/24/18	Dealer	Derived	F
2/24/18	53	The Dealer shall start giving cards to the rightmost Player first, before moving to each existing Player to the left, dealing themselves last	2/24/18	Dealer	From Video	F
2/24/18	54	The Player shall be allowed to Double Down; Doubling their bet and only receiving one additional card for that hand.	2/24/18	Player	From Video	F
2/24/18	55	The Player shall notify the PitBoss when Doubling Down with a bet lower than their initial bet	2/24/18	Player	From Video	F
2/24/18	56	The Player shall notify the PitBoss when Doubling Down on a hand that is worth 12 or higher	2/24/18	Player	From Video	F
2/24/18	57	The Player shall be allowed to Surrender after receiving their first two cards, but not after receiving additional cards.	2/24/18	Player	From Video	F
2/24/18	58	When a Player Surrenders, they shall receive half of their bet back in their balance, their hand is over, and their cards will be removed.	2/24/18	Player	From Video	F
2/24/18	59	After the initial deal, the Dealer shall deal all Players before themselves.	2/24/18	Dealer	From Video	F
2/24/18	60	The Dealer shall follow the same procedure every time when dealing themselves.	2/24/18	Dealer	From Video	F
2/24/18	61	The Dealer's procedure for dealing itself will be as follows: takes a card on all hands 16 and lower, must stand on 17-21, if hand goes exceeds 21 after taking a card Dealer busts and all remaining Players win.	2/24/18	Dealer	From Video	F
2/24/18	62	The Dealer shall not be allowed to change the shoe type once a game has started.	2/24/18	Dealer	Derived from Requirements	F
2/24/18	63	The maximum number of cards 1 user shall be allowed to receive is 10.	2/24/18	Dealer/Player	From IDL	F
2/24/18	64	The Dealer UI shall have an End Game button that shall begin the process to end the game for all players and change the status.	2/24/18	Dealer	Derived	F
2/24/18	65	The Dealer & Player GUI shall display a clock for each Player showing their remaining time to take action.	2/24/18	Dealer/Player	Derived	F
2/24/18	66	The Dealer GUI shall display the current status of all Player's in the game.	2/24/18	Dealer	Derived	F
2/24/18	67	The Player GUI shall have a widget that allows a bet to be decided.	2/24/18	Player	Derived	F
2/24/18	68	The GUI for all users shall display the uid of all users in the current game.	2/24/18	Dealer/Player	Derived	F
2/25/18	69	The Player shall be allowed use the GUI to make decisions on whether to take a card, stand, double down, or split.	2/25/18	Player	Derived	F

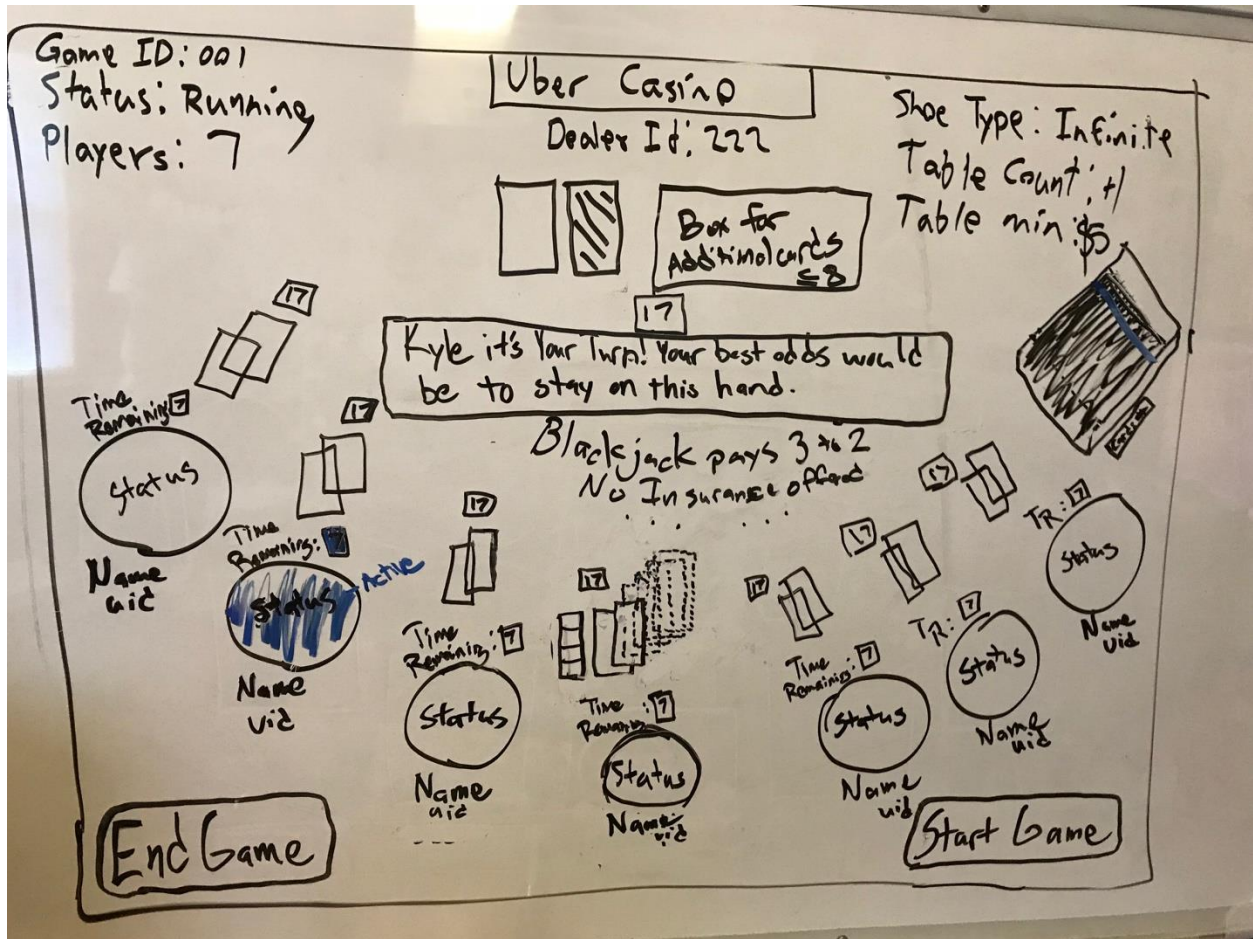
2/25/18	70	The game shall begin once at least 1 Player has joined the game and placed a bet.	2/26/18	Dealer	Derived	F
2/25/18	71	The Player shall be able to see all available games being published by Dealers.	2/27/18	Player	Derived	F
2/25/18	72	The Player shall have the button to leave a game displayed at all time when in a game.	2/28/18	Player	Derived	F
2/25/18	73	The Dealer shall have a button for each shoe option to host a table.	3/1/18	Dealer	Derived	F
2/25/18	74	The Dealer shall deal 1 card to the Player when the Player requests a card.	3/2/18	Dealer	Derived	F
2/25/18	75	If the Dealer deals a card and the Player's hand is lower than 21, the dealer shall wait for the Player's next request.	3/3/18	Dealer	Derived	F
2/25/18	76	The Dealer & the Player shall display the hand's current value.	3/4/18	Dealer/Player	Derived	F
2/25/18	77	When the Player click's the Button to take a card, the player_action_t shall be changed from "idle" to "hitting" and published, then changed back to "idle".	3/5/18	Player	Derived	F
2/25/18	78	When the Player click's the Button to stand, the player_action_t shall be changed from "idle" to "standing" and published, then changed back to "idle".	3/6/18	Player	Derived	F
2/25/18	79	When the Player click's the Button to split, the player_action_t shall be changed from "idle" to "standing" and published, changed back to "idle", and the Player shall increase their bet by 100%.	3/7/18	Player	Derived	F
2/25/18	80	When the Player click's the Button to double down, the player_action_t shall be changed from "idle" to "doubling" and published, changed back to "idle", and the Player shall increase their bet by 100%	3/8/18	Player	Derived	F
2/25/18	81	When the Dealer click's the button to Host a game, the Dealer shall create and publish a Game instance (game state, uid, dealer uid, and player states) and set the game_state to waiting_to_join to allow players to see the game being published.	3/9/18	Dealer	Derived	F
2/25/18	82	When at lease 1 player has published a join game option, the Dealer shall be shown a button option to start the game with all current players, and the game_state shall be changed to waiting.	3/10/18	Dealer	Derived	F
2/25/18	83	Once the Dealer clicks the start game button, they shall change the game_state to playing.	3/11/18	Dealer	Derived	F
2/25/18	84	Once the Dealer changes the game state to playing, the first hand shall be dealt once all players in the game have published the hitting action.	3/12/18	Dealer	Derived	F
2/25/18	85	The system shall support up to 3 separate hands per Player.	3/13/18	Dealer/Player	Derived	F
2/25/18	86	If the Player has been dealt 10 cards and publishes a hit action, the Player shall automatically win the hand and cards will be removed.	3/14/18	Player	Derived	F

2/25/18	87	The Dealer shall only be allowed to host 1 game at a time.	3/15/18	Dealer	Derived	F
2/25/18	88	When the game state is 'playing', the Dealer shall publish the index of the current active player	3/16/18	Dealer	Derived	F
2/25/18	89	The Player shall have 'player action' set to 'idle' until the Dealer publishes that Player's index in the current game as the 'active_player'	3/17/18	Player	Derived	F
2/25/18	90	Both the Dealer and the Player shall keep track of and display all cards currently in the game.	3/18/18	Dealer/Player	Derived	F
2/25/18	91	The Dealer shall publish the state of the entire game at all times.	3/19/18	Dealer/Player	Derived	F
2/25/18	92	The Dealer shall display game feedback to all current Players of the game.	3/20/18	Dealer	Derived	F
2/25/18	93	The Dealer shall shuffle the deck when the end of the shoe has been reached in an 8 deck shoe.	3/21/18	Dealer	Derived	F
2/25/18	94	The cards drawn shall be shuffled/sorted randomly.	3/22/18	Dealer	Derived	F
2/25/18	95	The Dealer shall only play out the remaining hand and then reshuffle once there is 25 cards remaining in the 8 deck shoe	3/23/18	Dealer	Derived	F
2/25/18	96	The cards in the shoe shall be determined when the game changes to playing.	3/24/18	Dealer	Derived	
2/25/18	97	When the Dealer ends the game, the player's shall receive back the current bet in their balance if the hand had not completed.	3/25/18	Player	Derived	F
2/25/18	98	The shoe shall be displayed to all users, to include the amount of cards remaining in the shoe.	3/26/18	Dealer/Player	Derived	F
2/25/18	99	The Player shall be shown options for all 3 playing type at all times during game play.	3/27/18	Player	Derived	F
2/25/18	100	The Player shall be allowed to switch between playing types at any point during the game.	3/28/18	Player	Derived	F
2/25/18	101	The table count shall be implemented using the High-Low Card Counting Strategy	3/29/18	Dealer/Player	Derived	F

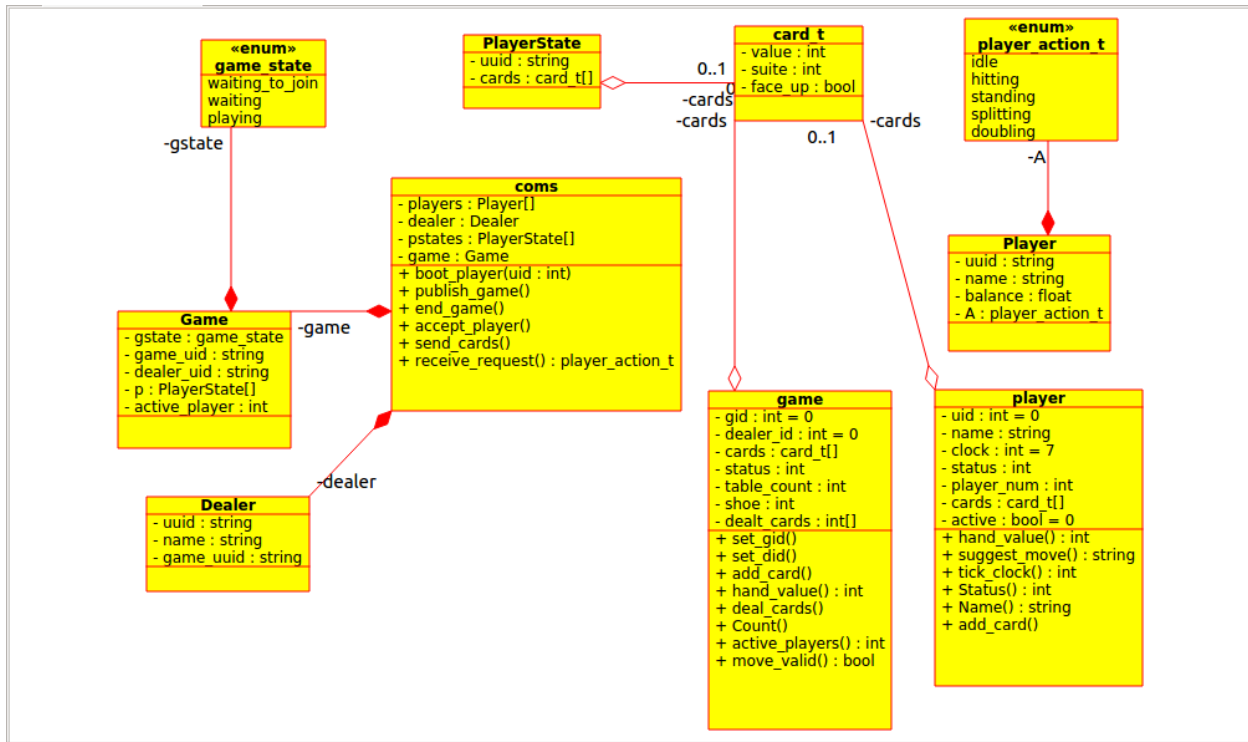
2/26/18	10 2	<p>Tthe High-Low Card Counting Strategy shall be caculated as follows:</p> <table><tr><td>RANK</td><td>VALUE</td></tr><tr><td>2</td><td>+1</td></tr><tr><td>3</td><td>+1</td></tr><tr><td>4</td><td>+1</td></tr><tr><td>5</td><td>+1</td></tr><tr><td>6</td><td>+1</td></tr><tr><td>7</td><td>0</td></tr><tr><td>8</td><td>0</td></tr><tr><td>9</td><td>0</td></tr><tr><td>10</td><td>-1</td></tr><tr><td>J</td><td>-1</td></tr><tr><td>Q</td><td>-1</td></tr><tr><td>K</td><td>-1</td></tr><tr><td>A</td><td>-1</td></tr></table> <p>For example, if the first ten cards to come out of the shoe were 3, 5, K, 7, Q, A, 8, 5, 4, 2, then the running count would be 1 +1 -1 +0 -1 -1 +0 +1 +1 +1 = +2.</p>	RANK	VALUE	2	+1	3	+1	4	+1	5	+1	6	+1	7	0	8	0	9	0	10	-1	J	-1	Q	-1	K	-1	A	-1	3/30/18	Dealer/ Player	Derive d	F
RANK	VALUE																																	
2	+1																																	
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10	-1																																	
J	-1																																	
Q	-1																																	
K	-1																																	
A	-1																																	
2/26/18	10 3	Once the game has started, the dealer instance will be automatic with no user input from the dealer instance.	3/31/1 8	Dealer	Derive d	F																												



Game Screen



Class Diagram



Communication

Source	Destination	Data sent	Description
Dealer	All subscribers	struct Game, where gstate = "waiting to join"	Host a game for other players to join
Player	Dealer	struct Player	Player joins a game and sends the dealer its information
Dealer	All Players	struct Game, where gstate = "playing"	Dealer starts the game
Player	Dealer	struct Player	Player makes a move
Player	Dealer	struct PlayerState	Gives the dealer the state of each player after each move
Dealer	All Players	struct Game, where gstate = "waiting"	In between hands when the dealer is waiting for all players to place bets