PitFail Report 1
An Online Financial Engineering Game

September 30, 2011

Software Engineering I, Group 3
https://github.com/pitfail/pitfail-reports/wiki

Michael Koval, Cody Schafer,
Owen Healy, Brian Goodacre
Roma Mehta, Sonu Iqbal
Avanti Kulkarni

Table of Contents

1 Individual Contributions

Responsibility	**Michal Koval**	**Cody Schafer**	**Owen Healy**	**Brian Good-acre**	**Roma Mehta**	**Sonu Iqbal**	**Avanti Kulka-rni**
Customer Reqs. (6)							100%
Glossary of Terms (4)	40%	10%	10%	10%	10%	10%	10%
Functional Reqs.							
→ Stakeholders (2)		100%					
→ Actors (2)		100%					
→ Goals (4)	50%	50%					
→ Casual UC (5)		100%					
→ Dressed UC (11)	40%	20%		40%			
→ UC Diagram (4)		100%					
→ UC Tracability	100%						
Seq. Diagrams (9)						100%	
Nonfunc. Reqs. (6)						100%	
Domain Analysis							
→ Concepts (12)			100%				
→ Associations (4)			100%				
→ Attributes (3)			100%				
Contracts (6)					100%		
User Interface (8)	100%						
Plan of Work (3)				100%			
References (1)	14%	14%	14%	14%	14%	15%	14%

2 Customer Statement of Requirements

Investors today are seeking more effective financial tools that not only motivates them to invest in the stock market and improve their decision making skills but also an application that is interesting enough to keep using. Our goal is to build a system that is less focused on simulation than on playing a game. Existing trading simulations mimic the inconveniences of trading stocks on real markets; while this might help future traders to practice, it is out of place for the typical internet user. PitFail's philosophy is that the market for trading *practice* is already well-handled by games such as Investopedia. PitFail instead believes that it is more important to teach theory than mechanics. In contrast with the existing alternatives, PitFail offers number of differentiating features: while the core program centers around buying and selling of liquid assets (stocks, options; anything with available market prices), PitFail aims eventually to users to trade directly with each other in non-liquid assets such as derivatives. To achieve a low-threshold for getting in to the game, PitFail may be played using users' existing accounts (such as Twitter, smart phones or Facebook) with essentially no setup.

PitFail creates a virtual stock world, creating a network of stock investors, through which they trade real-world stocks without the risk of losing real money. Unlike existing trading simulations, PitFail does not require the players to go through a time-consuming registration process. Players can login to the system using their existing e-mail addresses and the system remembers the players for their next use. As such, PitFail requires essentially no commitment and it is easy for players to get started. Initially, the player is given a fixed amount of startup funds and uses these funds to buy virtual stocks.

You could take a trading game different ways -- Investopedia, which is excruciatingly tied to the real world, or Neopets which is isolated and pristine -- but the nice thing about capitalism is that we can play with any rules, so long as they're consistent. But so many (all that I'm aware of) of the games that have been written so far left out something so important: you can't enter (enforced) contracts with other players.

It's not a trivial detail -- if you can't enter contracts, you can't turn intangible ideas into *assets* -- ie, you can't commoditize all the things you might like to commoditize (well, maybe you can if that's nothing). There's a good reason they don't do this, of course: to enforce contracts you either need a legal system (doable -- Wikipedia has one, but a serious impediment still) or contracts that a computer can enforce. PitFail makes a compromise -- users can enter into contracts (in the form of derivatives), but the rules are reduced to a simple set that the system can enforce, yet that can be combined creatively by the players.

This adds a new aspect to the game -- illiquidity. The PitFail stock exchange is simulated as a perfectly efficient, perfectly liquid market. This is of course unrealistic -- in the real world, trading volume is finite, trades are not made constantly, not all trades are made at the marginal price. Alas, it would be hard for PitFail to simulated illiquidity in stocks -- unless we have access to an actual massive population of traders, it would be simply *too* illiquid to be worth playing.

There are many options for a player to choose from once he/she logs in:

1. Player can join a team (a small group of already registered players). Once player joins a team, the player will buy/sell/compete with other players/teams using collective portfolio of the team.

2. Player can join a league (a group of already registered players) where the members of a league compete with each other using their individual portfolio.

3. Player can play in the "Global League" which includes all players.

When the player trades and builds a portfolio, the system should have access to real-time stock information and should adjust the value of a player's investments based on this real time stock info. PitFail retrieves actual stock prices from a third-party source Yahoo! that monitors stock exchanges and maintains up-to-date (though delayed) stock prices. If the corresponding actual stock loses value on a real-world stock exchange, the player's virtual investment loses value equally. Likewise, if the corresponding actual stock gains value, the player's virtual investment grows equally.

As a game, a crucial part of the application is maintaining player portfolio. The application provides every player with portfolio to view his or her history and modify his or her current investments (i.e. currently owned stocks and derivatives). In addition to the securities currently owned by the player, the player is able to view a few summary statistics about their portfolio, such as a history of net worth over time, and an indication of which assets have increased in value since their purchase. What the player ultimately cares about, of course, is net worth in the future -- that's what they are trying to optimize. We can't tell them that, of course, nor should we, since it's the whole point of playing the game. We should even be careful in categorizing assets by change in value -- users will of course purchase assets that perform oppositely to hedge risk. Basically, we don't want to decide strategy for the player; we want to give them information and let them decide strategy.

To add a flavor of a game, players can monitor each other's progress by viewing a feed of recent activity and browsing leader boards. PitFail also offers aggregate feeds of recent activity. This allows a group of people to keep abreast of their friends' or enemies' activities. Remember, this is not real personal information we're talking about -- we're willing to sacrifice privacy (if you can call it that) for a competitive spirit. PitFail provides the players with the ability to comment on other's trades when browsing recent activity or viewing another user's portfolio. These comments make players feel involved and part of a larger community. One additional feature PitFail provides is the ability for players to "upvote" and "downvote" trades based on their opinion of trade. PitFail can then rank users and assign status symbols (e.g. badges) to users with the strongest ability to vote predictively. Of course, predicting is only so good if you can't make good trades yourself -- but it's interesting to see both rankings nonetheless. This type of ranking appears to be unique to PitFail. Another feature that appears to be unique to PitFail is that it allows users to design their own securities (i.e futures or options) , thus creating new financial products. Even without a court system to enforce complex contracts, custom securities allow PitFail's users to a new financial environment.

As mentioned, PitFail can be accessed via a website, Twitter, Facebook, or an Android application. Each of these methods have their own purposes. As financial trades are compact and atomic and that they can be expressed through small messages, PitFail provides a Twitter and Facebook interfaces where players can buy/sell securities by tweeting to a particular account/ writing post on Facebook account wall . Twitter and Facebook provide a familiar interfaces to use the system. Also, as no registration is required which makes it easy to use. PitFail can also be accessed via a website that offers additional set of features (In addition to all of the functionality provided by the Twitter interfaces): like view portfolio, design custom securities, interact socially with other users and play against or in co-operation (teams/leagues) with other users. Also, website helps to generate some advertising revenue, making it desirable to attract users to the PitFail website by offering features that are not possible via Twitter/Facebook. Android interface provides features that are similar to that of the website, with the addition of notifications to the user when some event occurs within PitFail.

The motivation for implementing teams/leagues comes from the apparent fact that most (perhaps all) trading games target students and teachers as their principal user base, suggesting this accounts for most of the people who actually play these games. While PitFail is mostly seeking a different niche -- the casual online player -- the classroom market is too big to ignore completely, hence a feature that makes it possible for students to play against each other in a league.

Below is the list of customer requirements:

1. **REQ-1** Stock Market Simulator Website: Investors are looking for an effective tool that allows users to invest and learn without having to invest real money and also allows them to interact with other users more effectively to make the game really enjoyable.

2. **REQ-2** Android Application: Mobile users who like having native applications can use such system with quick access.

3. **REQ-3** Access via Twitter/Facebook: Users who heavily use social networks like Facebook/Twitter can connect to PitFail easily.

4. **REQ-4** Simple User Interface: Users are looking for simple interface that welcomes new users and guides the new user through portfolio management.

5. **REQ-5** Zero-Configuration Setup: Users should not have to set any settings or explicitly create an account to begin playing.

6. **REQ-6** Updated Stock Information: Application should present stock symbols, company names, stock history, updated stock values and prices amongst other details.

7. **REQ-7** Basic Trading: Users should be able to buy and sell stocks whose values change over time.

8. **REQ-8** Large, Liquid, Efficient Market: The simulated “exchange” should present the illusion of a large, liquid and efficient market -- stocks are traded constantly, at marginal price, and each individual trade is small compared to the total trading volume.

9. **REQ-9** Relation to the outside world: The values of stocks should be in some way related to the outside world so that users have information to base trading decisions on.

10. **REQ-10** Player Portfolio: Each player must have separate portfolio that gives him/her option to buy/sell new securities, view currently owned securities.

11. **REQ-11** Evaluate Portfolios: Securities owned by each player should be periodically evaluated and should be updated to their current value.

12. **REQ-12** Advertisements: The website must contain appropriate and interesting advertisements relating to finance and stock

13. **REQ-13** Coordinators for Supervision: Users must be able to create their own leagues.
14. **REQ-14** Summary Statistics: The website should provide users with a few summary statistics about their portfolio -- aggregate value over time, which securities have increased in value. The website shouldn't usurp the role of deciding strategy for the player; only the most basic of stats should be displayed.
15. **REQ-15** Voting: players should be able to up/down-vote each other's trades. Vote tallies should be visible to other users.
16. **REQ-16** Commenting: players should be able to comment (via the website -- you can already comment on anything via Twitter) on each other's trades. Comments should be visible to all users.
17. **REQ-17** Moderation: There should be at least a minimal degree of comment moderation so blatantly offensive comments can be removed.
18. **REQ-18** Designing Derivatives: Players should be able to enter into contracts with each other that will be enforced by the PitFail system.
19. **REQ-19** Guided designing of derivatives: The website should guide players into common formats for derivatives to make it easier for new players to figure out.
20. **REQ-20** Rankings: On the website players should be able to see rankings of all players by portfolio value (liquid assets only), and by voting score.

3 Representing Financial Products for Online Simulation

3.1 Example: Options

There are different kinds of options, but the basic form goes something like: "on a preset date, trader A agrees that trader B may optionally (at trader B's discretion) buy X shares of XYZ for D dollars, from trader A."

Right away we see this will have some sharp edges in an online game:

1. It requires obtaining a decision from trader B on the specified date, while trader B may in real life be sleeping, be at work, be in the hospital, not care about the game anymore, etc.
2. If trader A doesn't have X shares of XYZ at the exercise time, the software will have to handle that in a way that's fair to both players, and doesn't require getting them out of bed.

Luckily, real life comes to the rescue. First, stocks, being traded on exchanges, are fairly liquid, and have a market value that can be easily looked up. So if, on the exercise date, trader B has the option of buying X shares of XYZ for D dollars, we already know what trader B wants to do: if X shares of XYZ is worth more than D dollars, she'll buy it; otherwise she won't. It's reasonable to imagine that trader B would much rather have the software make this obvious decision for her than have to remember to be online at the right time to make a trivial decision in a game.

The second problem is moot for a different reason: in real life, not only are stocks liquid, but *options* are liquid: they are set according to standard terms and traded on exchanges. Thus, in real life, options are rarely exercised; rather on the exercise date trader A simply buys back the option, which he can reliably do since there are thousands of other traders buying the same option. Likewise trader B simply sells it back. The option never gets used and the actual value of exercising it is reflected only in the change in its price.

Alas, in an online game where membership may be sporadic, derivatives cannot be liquid, so buying the option back from the exchange isn't feasible. However, stocks *are* liquid, so it's safe to assume that, if trader B can't buy the promised X shares of XYZ, she'll be content with the corresponding value of those shares in dollars.

3.2 Entering into a Contract

Since trader B gets positive value from the option contract and trader A gets negative value, in order for the contract to come about trader B needs to pay trader A for the privilege.

In the game, trader A can offer to "sell" the derivative to trader B -- meaning that, if trader B accepts, the derivative is created and they enter the contract. So for example, trader A can offer an option to B for \$35. If trader B accepts, trader B pays trader A \$35 and they enter the contract. Importantly, the \$35 is not part of the derivative -- it doesn't depend on the eventual execution of the derivative.

3.3 Representation

The proposed representation of a derivative consists of:

1. An exercise date,
2. A condition on which the derivative will be exercised,
3. A list of securities to be traded.

So for example, an option to buy 100 shares of GE on 9/18 for \$350 would be represented as:

1. 9/18
2. GE > \$3.5
3. [100 * GE, -350]

The - in -350 indicates that the money is moving from the buyer to the seller.

Representation of dates is clear, but the representation of the condition and the securities is not. It is described in the next section.

3.4 A Language for Securities

A security consists of two pieces of information:

1. The "flavor" (if a stock, the stock ticker symbol)
2. An amount, with a sign.

Stocks, derivatives and dollars would be possible flavors. If the sign is +, the security is to be moved from the seller to the buyer (in the option example, trader A is the seller and trader B is the buyer). If it's -, it is to be moved from the buyer to the seller.

3.5 Comparing Securities

Not all securities can be compared. This is simply because in a world where derivatives are not standardized and not traded on exchanges, it is impossible for software to know the value of a derivative, or to say if one derivative is more valuable than another

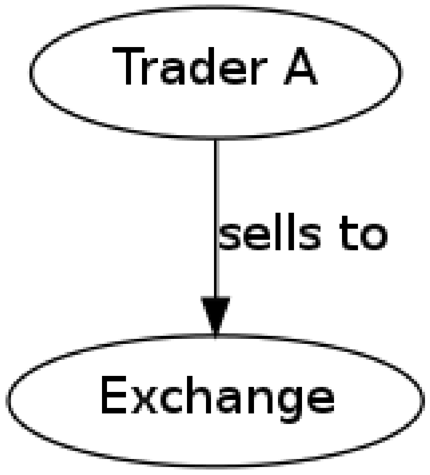
Therefore, the only comparable securities are:

1. Dollars
2. Stocks

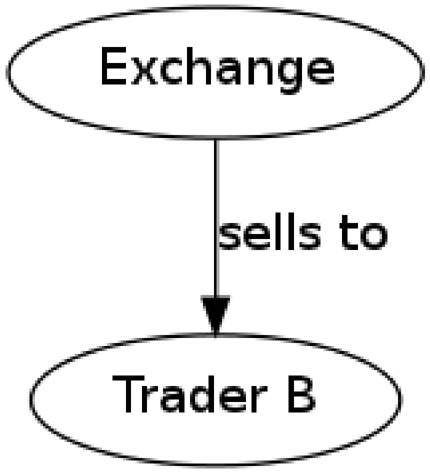
Securities are compared according to their dollar value at the present time. The dollar value of a stock is the last traded price of that stock.

3.6 Derivatives have endpoints

When trading on an exchange, you normally think of a derivative as looking like

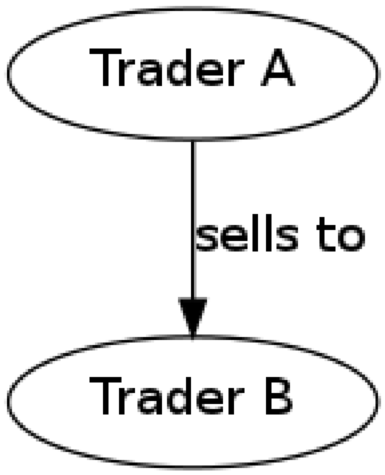


or



It would not be technically infeasible (or even harder) to use this representation in an online game, but it could lead to serious problems. In real life, because the exchange takes one half of the trade, it needs to put effort into enforcing a standard of behavior for the traders: importantly, the exchange puts limits on leverage and sets margin requirements. It's hard for software to do a good job of this -- it would likely lead to a high number of defaults.

In the game, a better representation is



importantly, neither trader A nor trader B *owns* the derivative; rather they each own one endpoint of it. An analogy would be a socket always having two endpoints (although sockets aren't normally traded).

Only the buyer endpoint of a derivative can be traded. This is necessary to prevent people absorbing their debt into dummy accounts which will then default. There is no reason that the buyer endpoint must have positive value -- so it map be vulnerable to the same tricks, but that is a problem that occurs in real life as well, and is a natural aspect to the strategy of the game.

3.7 Exercising Trades

What happens when, on the exercise date, trader B goes to buy security XYZ from trader A, and trader A doesn't have security XYZ? The answer depends on the type of security.

If XYZ is dollars, we can assume trader A is now in default and will need to declare bankruptcy, which is a whole topic in itself.

If XYZ is a stock, as mentioned earlier, it is a simple matter to convert XYZ to dollars, and then the rules for dollars apply.

The trickiest case is when XYZ is a derivative. First, remember that you don't trade derivatives, you trade endpoints, so what trader B is actually purchasing from trader A is one *endpoint* of derivative XYZ. The key point is that a derivative is just a contract: if trader A doesn't have the correct endpoint of XYZ, an XYZ derivative can be created at that time, giving trader B his promised endpoint, and letting trader A keep the other.

For trader B this is obviously acceptable -- she get what she was promised, but what about for trader A? In fact, this should be entirely acceptable for trader A as well, because derivative endpoints cancel each other out. This means that receiving the seller endpoint of XYZ is no different than giving away the buyer endpoint -- so again, the difference should be moot for trader A.

A problem *will* occur if derivative XYZ is past the exercise date, since this would involve editing the past. In real life, this would be impossible; in the game, it would be possible, but highly undesirable. However, assuming you can't directly trade XYZ after it has expired, the only time this would be an issue is when derivative XYZ is included as part of the contract of derivative ABC, and the exercise date of XYZ comes first. Since this can be detected at the time the user tries to create ABC, the error case can simply be presented to the user as not allowed, and the problem will never arise.

3.8 Liquidating Portfolios

When a user goes bankrupt (cannot pay all her debts) a portfolio will be liquidated, hoping to obtain as much cash as possible.

Cash is already cash. Stocks are liquid assets and will be immediately sold back on the exchange for cash. The remaining assets are derivatives and equity shares.

Sadly, or fortunately, depending on your point of view, in economics the value of products is determined by what the market participants are willing to pay for them, so the software cannot put a value of derivatives and equity. The software will put these at auction for a period, say 1 day, and any that are not sold will vanish.

4 A Prediction Market for Voting on Trades

4.1 Background

Sites such as StackOverflow allow users to vote on items posted by other users, to express approval or disapproval. Here that concept is extended with a prediction market to give users an incentive to vote and to vote well.

The implementation tries to work as much like a real prediction market as possible: the profit to the voters is tied as literally as possible to the object being voted on. This means that voting doesn't add any "new" concept of what a winner is -- it merely mimics the existing concept.

4.2 Implementation

4.2.1 When a trade is made

Say *Jen* sells a call option XYZ to *Nitish* for $100 (the other end of the option is currently held by *Atif*). To support voting, the following things happen at this time:

1. Jen and Nitish set aside $0.25 each into the *common pool*.
2. Nitish places 0.02*XYZ into the *buyer pool*.
3. Jen places 0.02*$100 into the *seller pool*.

The three pools are tied to this particular trade. The exist, potentially, forever, although the software may wish to reap pools on old trades.

The game then does a hacky "pre-money evaluation" of the pools. Since one half of a trade is always cash (please let this be true), the game values XYZ at $100 and both pools are valued at $2.00.

4.2.2 Casting Votes

Casting votes works exactly analogously to investing in a company. A vote costs a user $0.20, and in exchange they get $0.20 worth of the "company".

Say *Mike* thinks that Nitish got the better deal, so he casts the first vote, for Nitish. Mike pays $0.20 into the *buyer pool*. Now the *buyer pool* contains:

- $0.20 in cash
- 0.02*XYZ

Since 0.02*XYZ is considered to be worth $2.00, the pool now contains $2.20, so Mike's $0.20 entitles him to 9% of the pool, which he receives instantly in the form of $0.018 in cash and 0.02*0.09*XYZ.

A note on small numbers: Votes are supposed to be small compared to other trades, but not so small that users don't bother with them. Because votes are tiny enough to divide cents and be annoying when looking at balance sheets, they don't show up on balance sheets until they are liquidated and added to the user's single pool of cash.

Mike also receives, as a bonus for voting, 25% of the current contents of the *common pool*. This gives users an incentive to vote and to vote early. Users can only vote once per trade.

4.2.3 Showing the Results

Vote tallies are displayed along with the announcement for a trade on the PitFail website. The votes give a sense of how the community judges the prudence of that trade.

4.2.4 What happens to those tiny securities?

After voting, Mike now has 0.02*XYZ, which, as we said before, is a call option, the other end of which is held by *Atif*. From *Atif*'s perspective it is irrelevant who holds the other end of the option, and it doesn't show up in his balance sheet.

At some point, the exercise date for XYZ will come due, and it will be fully or partly liquidated. Any cash is returned to Mike's pool of cash; any stock is immediately sold and converted to cash.

Derivatives aquired through voting sit around in a user's "voting balance sheet", which is not shown.

4.2.5 Reputation

Sites such as Fluther and StackOverflow give "reputation" to users for receiving votes. PitFail voting also offers another possibility: reputation for *casting* votes accurately: "casting reputation" would simply be the total amount of cash received from casting votes to date. A user with a high casting reputation is good at judging other people's trades.

Casting or receiving reputation could be shown along with user names on the site to create a more competitive atmosphere.

5 Interacting with a Trading Simulation over Twitter

5.1 Motivation

Twitter is a service that is already widely used by many people, so there is a lower threshold of learning and discovery to play a game over Twitter than to use a dedicated website. It is not expected that the Twitter interface will duplicate all features of the website; rather users will be able to perform their most common tasks from an interface they are familiar with.

The bulk of the proposal is a syntax that represents the operations of the game. This syntax could integrate into any system that allows sending brief messages from named accounts. However, since Twitter is already well integrated this extra flexibility may be unnecessary.

5.2 Implementation

5.2.1 Accounts

The game has an account, tentatively named `pitfail`, and will listen for user tweets sent to `@pitfail`.

Users must explicitly associate their Twitter accounts with their PitFail accounts. Once Twitter name `joe` is associated with PitFail account `joe26`, tweets from `joe26` will be interpreted as belonging to account `joe`.

Another option is for a user to *start* playing FitFail over Twitter. This lets the user start playing faster and with no setup -- the first message they send to `@pitfail` creates an account. There's no way to automatically associate this with an OpenID login (that I know of) -- if the user later wants to use the PitFail website

The program may respond to tweets that require a response by sending tweets back to users.

5.2.2 Syntax of the commands

5.2.2.1 View Portfolio

```
@pitfail #portfolio
```

PitFail will respond with assets and liabilities in a human-readable form.

5.2.2.2 Buy a Stock

```
@pitfail #buy 100 shares of HP
```

or:

```
@pitfail #buy HP * 100
```

(See [[Products # A language for securities]])
or:

```
@pitfail #buy $250 of HP
```

PitFail will respond with an ACK if successful, or an error if the trade failed.

5.2.2.3 Sell a stock

```
@pitfail #sell 100 shares of HP
```

```
@pitfail #sell HP * 100
```

```
@pitfail #sell $250 of HP
```

5.2.2.4 Offer a security for sale to a specific user

```
@pitfail @joe #want 100 shares of HP for $250?
```

See [[Syntax for securities|Syntax]]

5.2.2.5 Accept an offer

```
@pitfail @laura #yes
```

This has an obvious ambiguity if *@laura* has made *@joe* more than one offer. Because that ambiguity could be used to trick *@joe*, it should not be allowed to make more than one outstanding offer to the same user from the same user.

5.2.2.6 Decline an offer

```
@pitfail @laura #no
```

5.2.2.7 Offer a security for sale at auction

```
@pitfail #auction 100 shares of HP
```

When an auction is started it is assigned an id, which is a unique, short string. The ID can be used when bidding on the auction.

5.2.2.8 Bid on an auction

```
@pitfail #bid $15 on #ae7
```

5.2.2.9 Comment on a trade

```
@pitfail @joe Are you serious?
```

5.2.2.10 Comment and vote on a trade

```
@pitfail @joe Are you serious? #down
```

```
@pitfail @joe Dammn... #up
```

These may be ambiguous, but it's not a big deal since little money is at stake. If the user wants to dig up an old trade and comment on it, they can use the ID assigned by pitfail:

```
@pitfail @joe Are you serious? #cc2f #down
```

5.3 Design considerations

- Operative words are given #tags so that users don't accidentally make trades when just trying to discuss them.
- When offering a security to another user, the role of the *@pitfail* account is minimized -- it's still there watching so it can actually make the trade, but the users feel as if they are just responding to each other. It makes it feel more like a real trade.

6 Glossary of Terms

Asset These show up on a users balance sheet, as things that they own. An asset is anything which may someday be converted co cash.

Coordinator PitFail user responsible for administering a *league*. See Actors and Goals for more information.

Game The trading of securities given a particular set of rules with the object to increase the value of one's portfolio.

Invite-Only League Restricted league where becoming a *member* requires approval by a *coordinator*.

League An instance of the *game* having particular rules associated with it. A *coordinator* may create a league for *players* to join.

Member *Player* who has a portfolio associated with a specific league. Members of a league compete against each other.

OAuth Protocol used for authenticating users and sharing information with PitFail on their behalf. See (`http://oauth.net/`).

OpenID Protocol used for authenticating users using their existing accounts. See (`http://openid.net/`).

OpenID Provider Third-party service that provides an OpenID identity for users; e.g. Google.

Player PitFail user participating in one or more *leagues*. See Actors and Goals for more information.

Portfolio Collection of *securities* associated with a specific user and league. Each user aims to maximize the value of his or her own portfolio.

Public League Open league where users can choose to become *members* with no approval.

Security Financial asset having a cash value. This includes *stocks*, bonds, and *derivatives*.

Stock Claim on the earnings of a company. To PitFail players, a stock is an opaque asset with fluctuating value.

Ticker Short string which uniquely identifies a stock.

7 Functional Requirements Specification

7.1 Stakeholders

- *Advertisers* who purchase ads on the website
- *Spectators* interested in finance who do not wish to invest in the real market
- *Teachers* of economics courses and their *students*

7.2 Actors and Goals

- A *Web Player* is a *player* who interacts with the *game* via the web browser interface.
  - Buys and Sell Stocks.
  - View and Modify Portfolio.
  - Create League.
  - Participate in Leagues.
- A *Twitter Player* is a *player* who interacts with the *game* via the Twitter interface. This actor contains has limited use cases compared to a Web Player.
  - Buys and Sells Stocks
  - Participates in Leagues
- A *MobilePlayer* is a *player* who interacts with the *game* via the Twitter interface. This actor contains has limited use cases compared to a Web Player.
  - Buys and Sells Stocks
  - View Portfolio
  - Participate in Leagues
- A *Coordinator* is responsible for administering a *league*.
  - Wants to effectively administer the tournament to provide either a learning experience to the *players*, or, alternately, an enjoyable experience to the *players*.
  - Desires a construct in which to effectively challenge others interested in security trading.
- The *database* is the store for all persistent data on interactions with the *system*. It stores data regarding all user portfolios and the association of authentications with users.
- A *stock information provider* is a supplier of stock pricing data for the present (within the margin of some minutes). They are queried for all data regarding actual market numbers. Currently, *Yahoo* is the *stock information provider* (via its Yahoo Finance API).
- *Authentication providers* allow us to uniquely identify users and associate some stored state with their unique identification.
- *Twitter* is utilized both as a authentication provider (for all *players* as well as a portion of the interface to the service.

7.3 Casual Use-Case Description

The system is designed such that customization and setup by a *player* is minimized. As such, league joining is unneeded by new players. In fact, to be a new *Twitter player*, one can simply send a *commanding tweet* and the PitFail system will automatically initialize the required backing data.

Account creation is omitted from the use case listing because account creation is always accomplished implicitly. Third party services are used for authorization, and all other setup is accomplished with defaults that may be changed at another point it time by the *player* as requested.

Actor	**Description**	**Short Name**	**UC#**
WebPlayer	Purchases a security from the market at the price the *stock price source* indicates is the market price for that security.	Buy	UC-1
WebPlayer	Sells a held security at the price indicated by the *stock price source.*	Sell	UC-2
WebPlayer	Indicates that they wish to begin participating in a particular league. Does not remove them from any league. Also note that leaveing a league is omitted to prevent people from gaming the system by joining a league, doing poorly, and leaving to essentially have a "clean record".	Join League	UC-3
WebPlayer	Examine the contrents of his or her portfolio, displaying information regarding their current assets and liabilities as well as how they have been progressing over time	View Portfolio	UC-4
WebPlayer	Examines details of a particular security.	Get Security Details	UC-5
WebPlayer	Checks league statistics. Provide a clear view of the leaderboard as well as changes over time.	View League Stats	UC-6
TwitterPlayer	Purchases a security from the market at the price the *stock price source* indicates is the market price for that security.	Buy via Twitter	UC-7
TwitterPlayer	Sells a held security at the price indicated by the *stock price source.*	Sell via Twitter	UC-8
TwitterPlayer	Query portfolio value & other details.	Portfolio Info	UC-9
TwitterPlayer	Changes his or her current (default) league. The default league is the league which UC-1(Buy) and UC-2(Sell) requests are sent to when a league is not specified in the command string.	Change Default League	UC-10
Coordinator	Creates a league.	Make League	UC-11
Coordinator	Modifies a league's settings. A coordinator will need to manage a league via changing settings regarding the league.	League Settings	UC-12
Coordinator	Add an additional Coordinator to a league.	Add Coordinator	UC-13
Coordinator	Remove a coordinator from the league.	Remove Coordinator	UC-14
Coordinator	Delete a league.	Delete League	UC-15
Coordinator	Accept or decline requests to join a league.	Manage League	UC-16
Coordinator	Invite players to a league.	Invite to League	UC-17
WebPlayer	Authenticates with the system.	Authentication	UC-18
WebPlayer,	Has their initial account (portfolio tracking)	Create User	UC-19
TwitterPlayer	created.		

... continued on next page

Actor	Description	Short Name	UC#
WebPlayer	Vote on trade.	Vote	UC-20
TwitterPlayer	Vote on trade via a Twitter repost.	Vote by Tweet	UC-21
WebPlayer	Create derivative.	Derivative Designer	UC-22
WebPlayer	Accept offer of a derivative.	Accept derivative	UC-23

7.4 Fully Dressed Use Cases

7.4.1 UC-1: Buy

Related Requirements: REQ-1, REQ-2, REQ-6, REQ-7, REQ-8, REQ-9

Initiating Actor: Any of: Webplayer, TwitterPlayer, MobilePlayer

Actor's Goal: To purchase a security from the market, to add it to his portfolio, and see his updated portfolio.

Participating Actors: Database, Securities, Stock Price Source, Yahoo!

Preconditions: The user should have created an account, be in a league with settings that allows the "BUY", and have enough money to perform the BUY of the security.

Postconditions: The user needs to be able to see his purchased security in his portfolio and track the progress of the security in his portfolio until he "SELLS" it.

Flow of Events for Successful Buy:

1. → The *Player, Webplayer, or TwitterPlayer* determines a *Security* and how much of it to "BUY".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of money the *Player* has.
5. ← *Database* sends the amount of money for the *Player* to the System.
6. ← *System* checks that there is enough money for compelete the transcation.
7. ← *System* signals the *Database* to complete the transcation for a *Player*, *Security*, and the quantity.
8. ← *Database* signals the *System* the transcation is complete.
9. ← *System* signals to the *Player* "Transcation Completed."

Flow of Events for Unsuccessful Buy:

1. → The *Player, Webplayer, or TwitterPlayer* determines a *Security* and how much of it to "BUY".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of money the *Player* has.
5. ← *Database* sends the amount of money for the *Player* to the System.
6. ← *System* checks that there is enough money for compelete the transcation.
7. ← There is not enough money. *System* signals to the *Player* "Transcation Not Completed: Insufficient Funds."

7.4.2 UC-2: Sell

Related Requirements: REQ-1, REQ-2, REQ-6, REQ-7, REQ-8, REQ-9

Initiating Actor: Any of: Webplayer, TwitterPlayer, MobilePlayer

Actor's Goal: To purchase a security from the market, to add it to his portfolio, and see the updated portfolio

Participating Actors: Database, Securities, Stock Price Source, Yahoo!

Preconditions:

- User is logged in
- Contain in his portfolio at least the quantity of securities his is requesting to sell.

Postconditions:

- The user's portfolio will reflect the quantity of securities sold.

Flow of Events for Successful Sell:

1. → The *Player* determines a *Security* and how much of it to "SELL".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of the *Security* the *Player* has.
5. ← *Database* sends the amount of the *Security* the *Player* has to the System.
6. ← *System* checks that there is enough *Securities* to complete the transaction.
7. ← *System* signals the *Database* to complete the transcation for a *Player*, *Security*, and the quantity.
8. ← *Database* signals the *System* the transaction is complete.
9. ← *System* signals to the *Player* "Transaction Completed."

Flow of Events for Unsuccessful Sell:

1. → The *Player* determines a *Security* and how much of it to "SELL".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of the *Security* the *Player* has.
5. ← *Database* sends the amount of the *Security* the *Player* has to the System.
6. ← *System* checks that there is enough *Securities* to complete the transaction. There is not.
7. ← *System* signals to the *Player* "Transaction Not Completed: Insufficient Securities."

7.4.3 UC-4: View Portfolio

Related Requrements: REQ-1, REQ-2, REQ-6, REQ-10, REQ-11, REQ-14

Initiating Actor: Only *WebPlayer*, the similar UC-9 is provided for the *Twitter player.*

Actor's Goal: To view information regarding their portfolio. This information includes the currently owned securities, minimal statistics regarding those securities (as they relate to the current and past value of the portfolio), current avaliable capital (and similar minimal information regarding its change), and the overall value of the portfolio (also with some statistical information regarding changes over time). The actor desires this information to make decisions regarding what their next interaction with the system should be. They use this info to decide to sell stock they have or buy an increased number of shares of stock they have).

Participating Actors: *Stock information provider*, *Database*

Preconditions: None, note that authentication & account creation are handled within this use case.

Postconditions: None, this is a stateless action. Information is displayed to the user but no internal actions are taken.

Flow of Events for Main Success Scenario:

1. → *Web player* browses to a page which will display his portfolio.
2. ← *System* checks for authentication and when it does not exsist (a) runs the authentication (UC-18). Checks for a associated *user* in the system and when there is none runs (b) user creation (UC-19).
3. ← *System* requests the information about the user's portfolio for this particular league from the *Database*.
4. → *Database* returns the information regarding the portfolio.
5. ← *System* forms a query regarding all the currently held securities within the portfolio and dispatches it to the *stock info provider*.
6. → *Stock info provider* returns the requested data.
7. ← *System* forms a web view of the portfolio information and returns it to the *web player*

Additional Notes: When this use case is running the other contained use cases (UC-18 and UC-19), each of these perform their own sequence of interactions with the user. In the case of a failure in one of the included use cases, the users remains in the control of that included use case until the failure is resolved or another use case is initiated.

7.4.4 UC-5: View League Statistics

Related Requirements: REQ-1, REQ-6, REQ-9

Initiating Actor: WebPlayer

Actor's Goal: To view the performance of his or her portfolio relative to other league members. For a teacher, this may also be used to verify that his or her students are actively participating in the game.

Participating Actors: Database

Preconditions: The league that is being viewed exists and the league is either public or the user is a member.

Postconditions: None; this is a stateless action.

Flow of Events for Main Success Scenario:

1. → *Player* requests to view league performance.
2. ← *System* signals the *Database* for authentication and the league's leaderboard.

3. ← *Database* authenticates the user's ability to view the statistics and returns the league's leaderboard.
4. ← *System* returns a leaderboard of all league members.

Flow of Events for league does not exist:

1. → *Player* requests the league statistics page.
2. ← *System* signals the *Database* for authentication and the league's leaderboard.
3. ← *Database* signals the *System* that the league does not exist.
4. ← *System* returns "page not found" error.

Flow of Events for league is invite-only and the user is not a member:

1. → *Player* requests the league statistics page.
2. ← *System* signals the *Database* for authentication and the league's leaderboard.
3. ← *Database* signals the *System* that the league is invite-only and the *Player* is not a member.
4. ← *System* returns "access denied" error.

7.4.5 UC-6: Modify League Settings

Related Requirements: REQ-1, REQ-14, REQ-20

Initiating Actor: Coordinator

Actor's Goal: To modify settings for the coordinator's league. This includes modifying the league's name, nickname, starting funds, and security settings.

Participating Actors: Database

Preconditions:

- League that is being modified exists
- Initiating actor is a coordinator of the league that he or she is modifying

Postconditions:

- League name is still unique
- League nickname is still unique
- Starting funds is positive

Flow of Events for Main Success Scenario:

1. → *Coordinator* requests to view league settings page.
2. ← *System* signals the *Database* for authentication and the league's settings page.
3. ← *Database* authenticates the user's ability to modify the league settings and returns the league settings page.
4. ← *System* returns a league setting page populated with the current settings.
5. → *Coordinator* submits updated league settings.
6. ← *System* Validate new league settings
7. ← *System* sends updated settings to the *database.*
8. ← *Database* signals the *System* that the settings have been updated.

9. ← *System* signals the *Coordinator* "Settings have been updated."

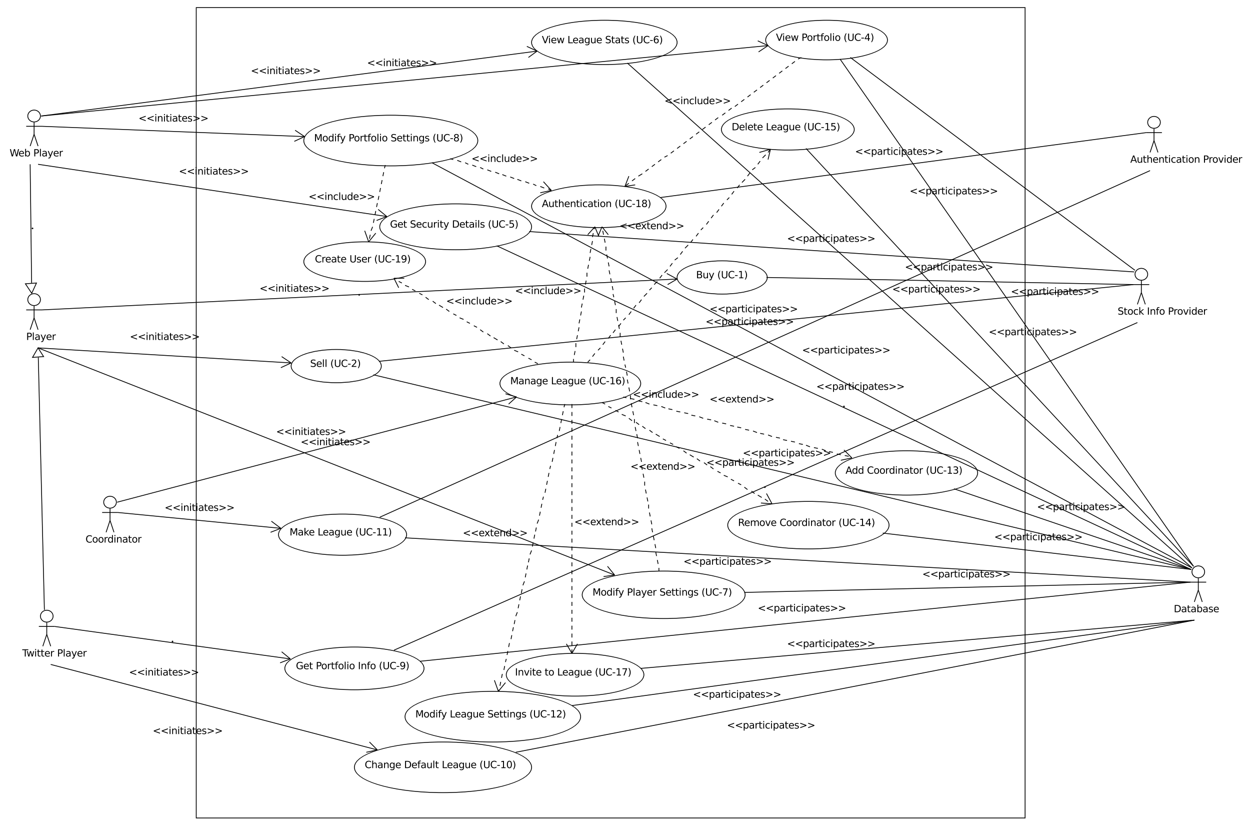
Flow of Events for league does not exist:

1. → *Player* requests the league settings page.
2. ← *System* signals the *Database* for authentication and the league's settings page.
3. ← *Database* signals the *System* that the league does not exist.
4. ← *System* returns "page not found" error.

Flow of Events for user is not a coordinator of the league:

1. → *Player* requests the league settings page.
2. ← *System* signals the *Database* for authentication and the league's settings page.
3. ← *Database* signals the *System* that the league is invite-only and the *Player* is not a member.
4. ← *System* returns "access denied" error.

7.5 Use Case Diagram



7.6 Use Case Tracability Matrix

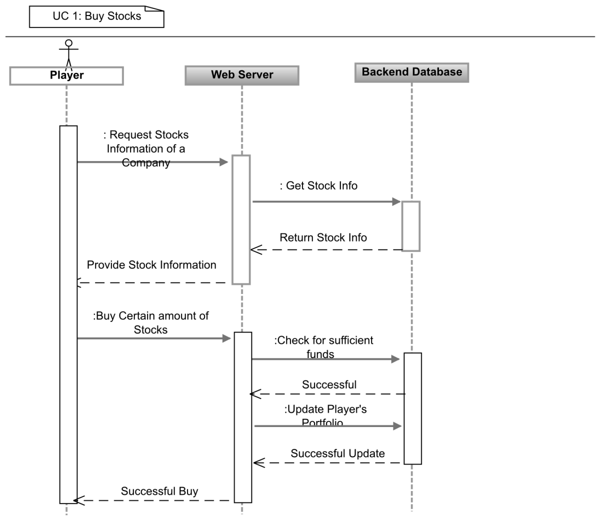
The following is the relationship between the use-cases defined above and the requirements discussed in the statement of requirements:

- **UC-1:** REQ-1, REQ-2, REQ-6, REQ-7, REQ-8, REQ-9

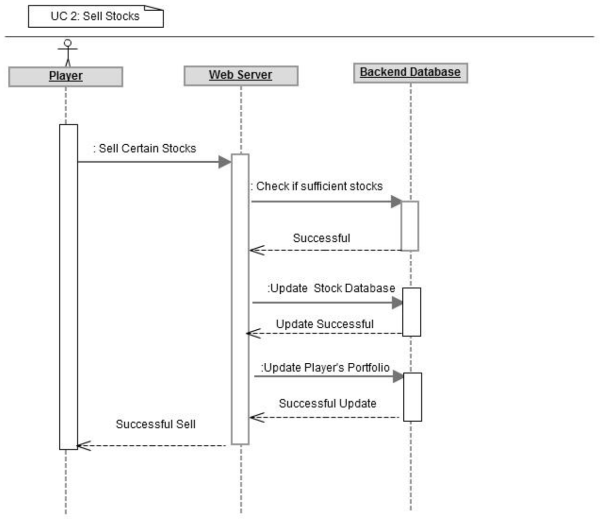
- **UC-2:** REQ-1, REQ-2, REQ-6, REQ-7, REQ-8, REQ-9
- **UC-3:** REQ-1, REQ-20
- **UC-4:** REQ-1, REQ-2, REQ-6, REQ-10, REQ-11, REQ-14
- **UC-5:** REQ-1, REQ-6, REQ-9
- **UC-6:** REQ-1, REQ-14, REQ-20
- **UC-7:** REQ-3, REQ-6, REQ-7, REQ-8, REQ-9
- **UC-8:** REQ-3, REQ-6, REQ-7, REQ-8, REQ-9
- **UC-9:** REQ-3, REQ-6, REQ-10, REQ-11, REQ-14
- **UC-10:** REQ-3, REQ-20
- **UC-11:** REQ-1, REQ-13, REQ-17
- **UC-12:** REQ-1, REQ-13, REQ-17
- **UC-13:** REQ-1, REQ-13, REQ-17
- **UC-14:** REQ-1, REQ-13, REQ-17
- **UC-15:** REQ-1, REQ-13, REQ-17
- **UC-16:** REQ-1, REQ-13
- **UC-17:** REQ-1, REQ-13
- **UC-18:** REQ-1, REQ-4, REQ-10, REQ-11, REQ-17
- **UC-19:** REQ-1, REQ-4, REQ-5, REQ-10, REQ-11
- **UC-20:** REQ-1, REQ-2, REQ-15, REQ-20
- **UC-21:** REQ-3, REQ-15, REQ-20
- **UC-22:** REQ-1, REQ-18, REQ-19
- **UC-23:** REQ-1, REQ-2, REQ-18, REQ-19

7.7 System Sequence Diagrams

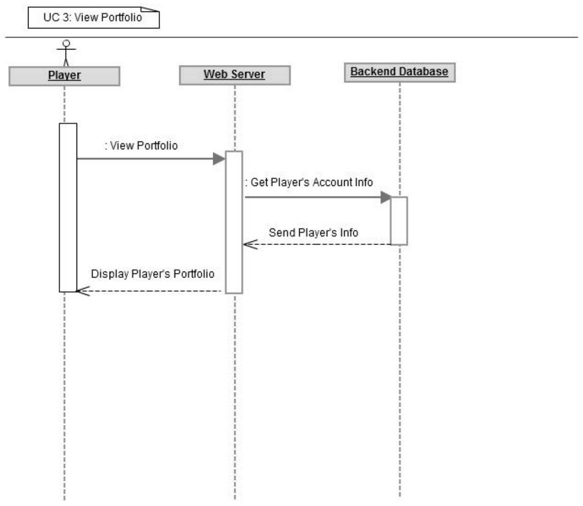
UC-1: Buy Stocks (Scenario: Successful operation)


UC 1: Buy Stocks
Player
Web Server
Backend Database
: Request Stocks Information of a Company
: Get Stock Info
Return Stock Info
Provide Stock Information
:Buy Certain amount of Stocks
:Check for sufficient funds
Successful
:Update Player's Portfolio
Successful Update
Successful Buy

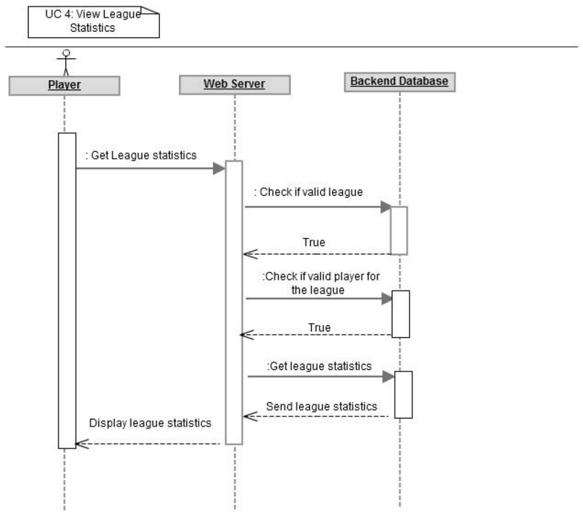
UC-2: Sell Stocks (Scenario: Successful Operation)



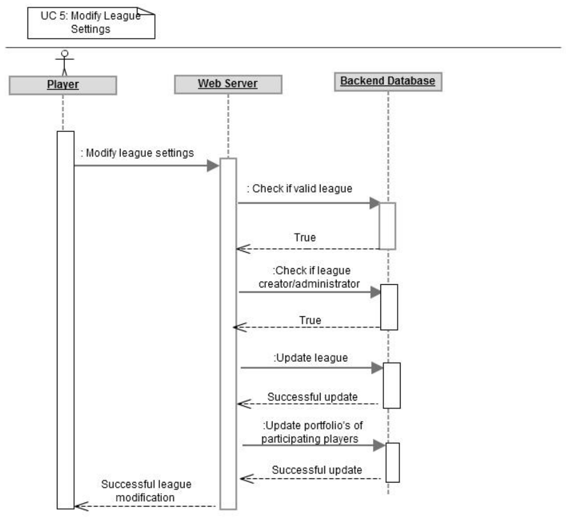
UC-3: View Portfolio (Scenario: Successful Operation)



UC-4 View League Statistics (Scenario: Successful Operation)



UC-5 Modify League settings (Scenario: Successful Operation)


UC 5: Modify League Settings
Player
Web Server
Backend Database
: Modify league settings
: Check if valid league
True
:Check if league creator/administrator
True
:Update league
Successful update
:Update portfolio's of participating players
Successful update
Successful league modification

8 Nonfunctional Requirements

8.1 Usability

The website should be easy to navigate irrespective of the type of user. It should have an appealing user interface which is pleasant to the eyes. A through consideration should be given for its aesthetic design in order to make it easily navigable and to have a good readability. The key focus should be on making the user interface as interactive as possible.

8.2 Performance

In order to have a great performance, the website should be as lightweight as possible by keeping minimum hardware demands. For it to be efficient, any task initiated by the user should be completed in a timely manner. The web server should be able to serve multiple requests and when a large number of users are logged in.

8.3 Reliability

In case of Internet failure, the user's portfolios should be brought back to a consistent state when user logs in the system again after the failed internet connection. The system should keep a backup of user's data in case of server failure. A proper care should be taken to handle a situation where a particular stock source is not available (i.e. Yahoo).

8.4 Security

The system should be secure enough such that user's privacy is maintained. The system should have a login process irrespective of the application i.e via Website, Mobile or Twitter interface.

8.5 Supportability/Extensibility

It should be feasible to extend any server components and include improved versions of modules which can be installed only by administrators. For future purposes of handling the load, it should be easier to include more number of servers to achieve load balancing. The system should be platform independent so that it is easy to move to newer technologies or the next versions of web server.

8.6 Maintainability

The system should be easy to maintain for the administrator. The administrator should be provided with an interface to interact with the entire system to make changes and to recover from any failure manually as well. The interface should give the administrator enough capability to perform future maintenance.

8.7 Testability

The system should be flexible enough to allow creating test databases and fake players so that feature test does not need to manipulate the actual database. This would ensure that it has great testability which can be used to build a more robust

8.8 Consistency

It should be ensured that the application is consistent throughout irrespective of what interface the player is using i.e whether website, mobile application or Twitter interface. Functionality might be limited on these different interfaces but it should not difficult for the user to shift from one application to another to access the system. Buzz words used should be same throughout and on all the interfaces to avoid confusion.

8.9 Documentation

The website should have enough material in the form of tutorial which can help the user to understand the rules and policies of the Stock fantasy league game and how it works.

9 Domain Analysis

9.1 Domain Model

9.1.1 Concept Definitions

Our Domain uses the following concepts (which appear in the Domain Model diagrams later):

9.1.1.1 User *Definition*: A human being playing the PitFail game.

9.1.1.2 Web Browser *Definition*: The User's browser, running on the User's computer.
Responsibilities:

- Take input from User
- Send requests to Web Server
- Receive responses from Web Server
- Render page content

9.1.1.3 Android Client *Definition*: The Android application: PitFail, running on the User's Android phone.
Responsibilities:

- Listen to user input via touch
- Send request to Web Server, receive response from web server
- Display appropriate screen with response action

9.1.1.4 Web Server
Definition: HTTP web server, running on PitFail's server.
Responsibilities

- Receive requests from Web Browser
- Delegate requests to Web Framework
- Receive responses from Web Framework
- Send Responses to Web Browser

9.1.1.5 Web Framework
Definition: Web framework APIs.
Responsibilities

- Receive requests from Web Server
- Convert requests to structured data and delegate to appropriate handlers
- Receive rendered pages in the form of structured data and convert to markup
- Send responses to Web Server

9.1.1.6 Page Renderer
Definition: Creates a presentation aimed at the User in the form of structured data.
Responsibilities:

- Decide what information should be rendered
- Convert prices/balance sheets/news to human-readable form
- Send rendered pages to the Web Framework

9.1.1.7 OAuthConsumer
Definition: Takes the role of the "consumer" in the OAuth protocol.
Responsibilities:

- Receive requests from Web Framework
- Send requests for authentication to Twitter.com
- Receive + store session secrets from Twitter.com
- Inform Login Manager of new logins

9.1.1.8 Stock Trader
Definition: Is in change of the logic of translating high-level trades into model operations.
Responsibilities:

- Translate an atomic trading operation (buy, sell, offer to player, accept, decline) into a model operation.
- Decide if a trading operation is legal in terms of which user is performing it, the current state of their portfolio, the current prices of stocks.
- Manipulate the model to reflect the results of a trade (if it is valid).

9.1.1.9 Price Fetcher
Definition: Gets real-world stock prices.
Responsibilities:

- Receive requests for price information from various components
- Request new price information from Price Source
- Receive price information from Price Source
- Maintain a cache of recent price quotes

9.1.1.10 Login Manager

Definition: Handles the current user login.

Responsibilities:

- Receive new login information from OAuthConsumer
- Store current login information for the session
- Query the Model to check for existing user information
- Update the Model to reflect new user information

9.1.1.11 Web Controller

Definition: Receives and processes requests delegated by the Web Framework.

Responsibilities:

- Receive requests delegated by the web framework
- Parse user-supplied data into an internal form
- Invoke appropriate operation in the Stock Trader
- Inform the Page Renderer of the results of the operation

9.1.1.12 Twitter Listener

Definition: Provides an interface for users to play PitFail via Twitter.

Responsibilities:

- Maintains a connection with Twitter.com and listens for tweets
- Delegates tweets to the Interpreter
- Receives responses from the interpreter and sends them as tweets

9.1.1.13 Facebook Listener

Definition: Provides an interface for users to interact with PitFail via Facebook.

Responsibilities:

- Listens to wall posts on PitFail Page and maintains a connection with Facebook.com
- Delegates the wall posts with requests to buy/sell to the interpreter
- Receives responses from the interpreter and sends them as a response to the Wall posts as comments.

9.1.1.14 Interpreter

Definition: Interprets text-based trading commands.

Responsibilities:

- Receive text commands from Twitter Listener and Facebook Listener
- Delegate commands to the Parser and receive a structured representation
- Send structured commands to the Stock Trader and receive a response
- Convert response to text and send back to the corresponding Listener

9.1.1.15 Parser

Definition: Converts human-entered text to structured trading commands.

Responsibilities:

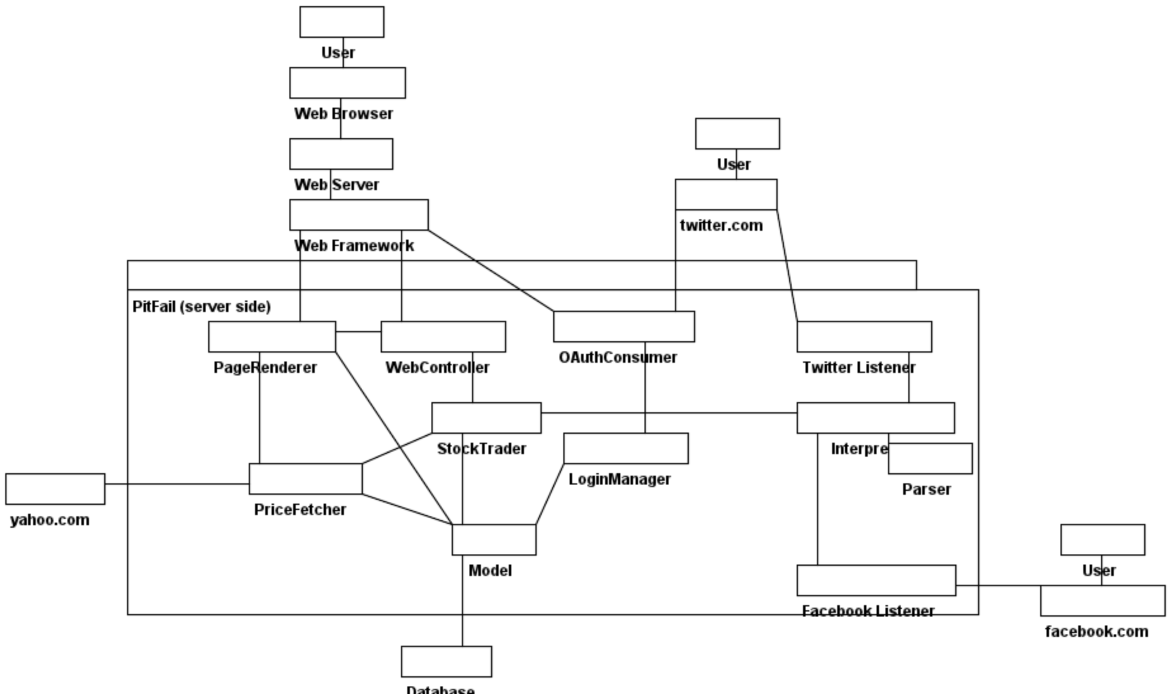
- Receive text commands from the Interpreter
- Convert commands to structured from

9.1.1.16 Model *Definition*: Handles persistent data.
Responsibilities:

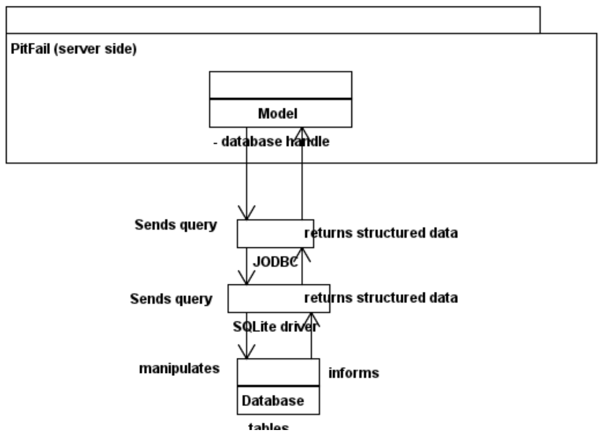
- Create and maintain a database handle
- Convert high-level model operations to database queries

9.2 Model Diagram

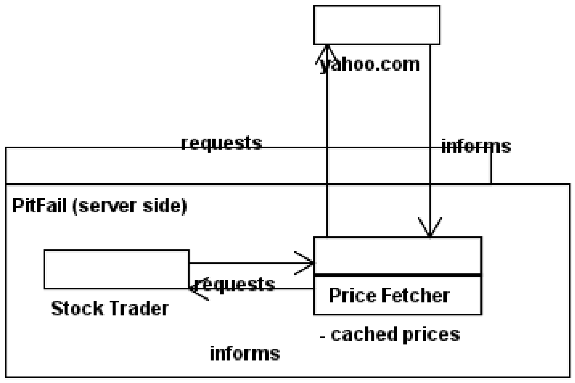
A sparse overview of the Domain Model looks like



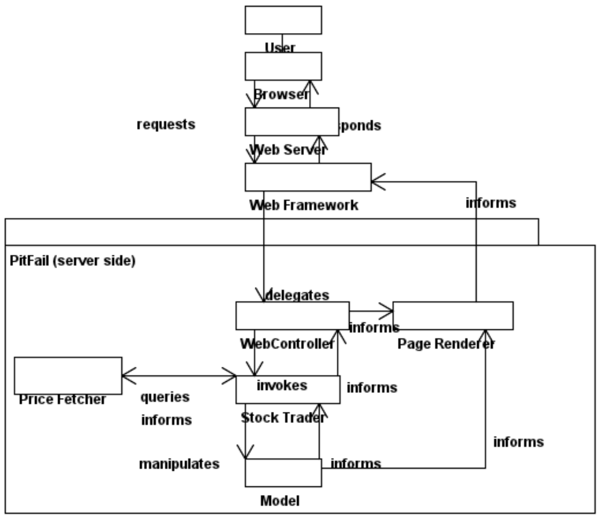
We can zoom in on the various parts to add attributes and associations:
The Model is the backend persistent storage:



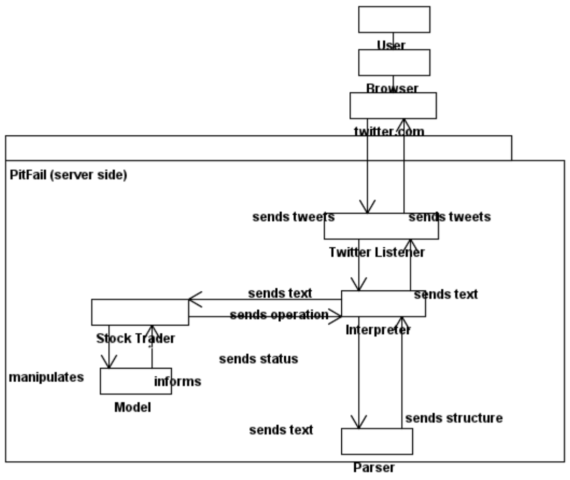
The Price Fetcher:



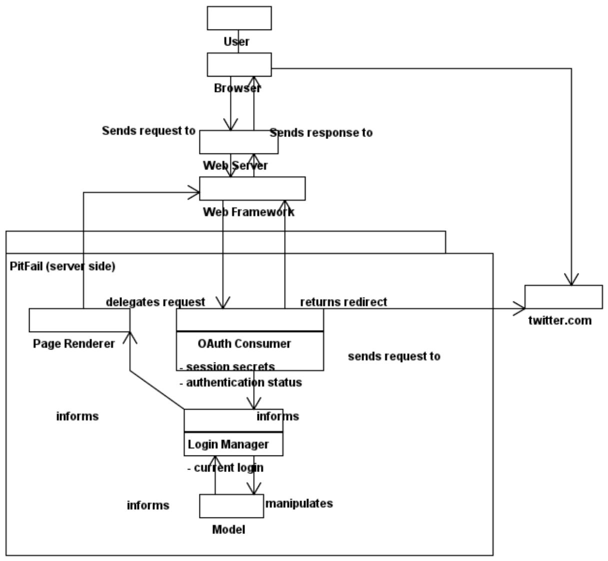
The Web trading front-end:



The Twitter trading front-end:



And the login process:



9.2.1 Attribute Definitions

Because it is primarily web-based, the PitFail program is mostly stateless. Persistent data is almost entirely stored in a database, the schema for which is described later.

A few attributes related to sessions and volatile information are stored within the program itself. These are described here.

Concept	**Attribute**	**Meaning**
Model	database handle	Allows communication with the database.
Database	tables	Relational tables. Schema described elsewhere.
Price Fetcher	cached prices	Stores recently retrieved prices to avoid DOSing the service

... continued on next page

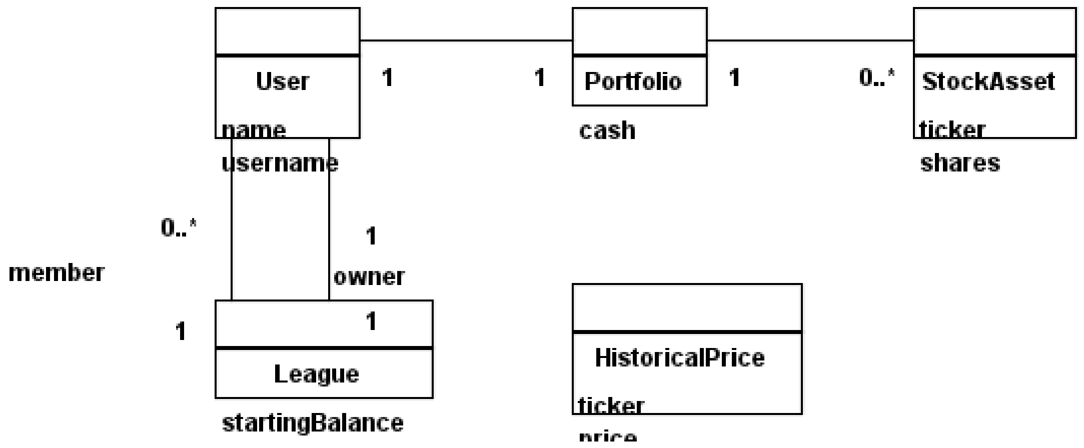
Concept	Attribute	Meaning
OAuthConsumer	session secrets	OAuth authentication secrets
OAuthConsumer	auth status	Whether authenticated, and if so as whom
Login Manager	current login	Currently logged in user

9.2.2 Association Definitions

Subject	Verb	Object	Meaning
Browser	sends request to	Web Server	The user has followed a link or performed at action
Login Manager	informs	Page Renderer	Reports login status so it can be displayed on page
Login Manager	manipulates	Model	When a new user logs in, remember them in database
Model	informs	Login Manager	Tells is this a new user and who are they
OAuth Consumer	informs	Login Manager	Tells about new authentications
Model	sends query	JODBC	Sends SQL to be performed on the database
JODBC	returns strc. data	Model	Results of query
Stock Trader	requests	Price Fetcher	Requests price data for a ticker symbol
Price Fetcher	informs	Stock Trader	Returns requested data
Price Fetcher	requests	Price Source	Requests price for ticker
Price Source	informs	Price Fetcher	Tells price for ticker
Stock Trader	manipulates	Model	To perform a trade
Model	informs	Stock Trader	Current status of portfolios
Interpreter	sends text	Parser	Human-written command to be parsed
Parser	sends structure	Interpreter	Interpretation (or failure)
Interpreter	sends operation	Stock Trader	Trade to be performed
Stock Trader	sends status	Interpreter	did it perform correctly
Twitter.com	sends tweets	Twitter Listener	Live stream of user's tweets
Twitter Listener	sends tweets	Twitter.com	Response to users
Web Framework	delegates request	Web Controller	User performed a trade in browser
Web Controller	invokes	Stock Trader	Specifies high-level trading operation
Stock Trader	informs	Web Controller	Whether the operation performed successfully
Web Controller	informs	Page Renderer	Reports status of trade back to user
Page Renderer	informs	Web Framework	How to render the new page
Model	informs	Page Renderer	Current status of portfolios

9.2.3 Attributes Stored Persistently in Database

Because this constitutes the majority of the state of PitFail, it is worth giving a rough schema for the database, even though this will never be visible to the user, because it indicates what data is expected to persist across sessions.



9.3 System Operation Contracts

9.3.1 UC 1: Buy Security

Preconditions:

- Verify user entry into the system
- Verify funds of the user
- Verify availability of security in desired quantity (or even more)

Post conditions:

- Update user portfolio
- Update database of system with the latest value of available security

9.3.2 UC 2: Sell Security

Preconditions:

- Verify the number of securities with the user (should be sufficient enough to sell security)

Post conditions:

- Update database with an increase in the number of available securities
- Update user profile

9.3.3 UC 3: View Portfolio

Pre conditions:

- Valid and updated values of user's account

Post conditions:

- Display of information is in a format readable and understandable by the requester

9.3.4 UC 4: View League Statistics

Pre conditions:

- Existence of Valid League
- Participation of valid users into the league

Post conditions:

- Display of information is in a format readable and understandable by the requester
- Display of statistics should be according to the access rights of the requester

9.3.5 UC 5: Modify League Settings

Pre conditions:

- Existence of Valid League
- Access of the League to its issuer

Post conditions:

- Update the League information according to the new changes
- Reflect the changes to the users participating in the league

10 User Interface Design

PitFail's website satisfies the requirements that the other interfaces cannot: enabling social interaction, providing a rich user interface, and coordinating leagues. Providing a rich set of features above what is available via Twitter is crucial for drawing existing users to the website. On balance, the website must have a simple interface that welcomes new users and guides the new user through the registration process. This starkly contrasts with many exiting trading simulations, such as the Stock Market Game's seven page registration procedure that requires a large amount of personal information.

10.1 Preliminary Design

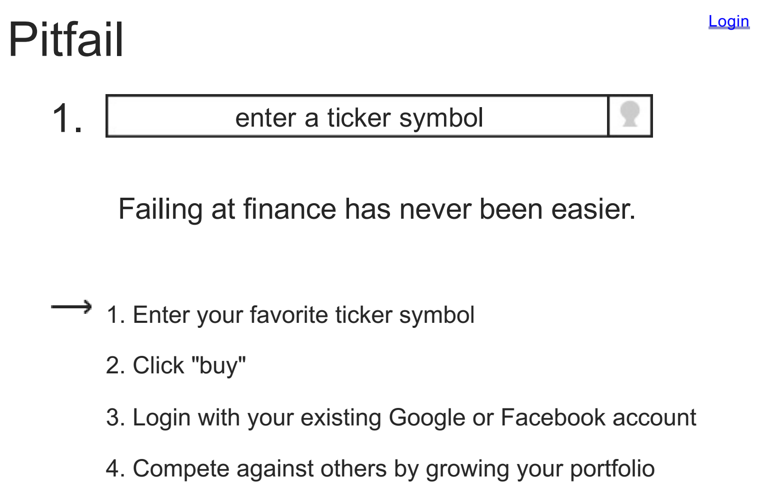
Simplifying the registration procedure starts with the welcome page. Instead of welcomes the logged-out user with a registration page, PitFail presents him or her with a simple four-step guide to purchasing his or her first stock. Existing users can bypass this guided process at any time by following the "login" link that is in the top-right corner of ever page. This intentionally mimics the login method on popular websites such as Facebook, Google, and Reddit.

10.1.1 Welcome Page for New User

If the user is logged out, he or she is assumed to be a new user and is presented with a guided login process. Existing users can skip the account registration by using the OpenID "login" link in the upper-right corner of the page. This design intentionally designed to mimic the behavior of popular websites such as Facebook, Google, and Reddit.

New users, on the other hand, are guided through the process of purchasing their first security. Guiding new users through their first purchase helps the new users gain familiarity with PitFail's user interface before confronting the full complexity of portfolio management.

First, the user is asked to enter a stock ticker symbol into the search box to request a quote:



Pitfail

Login

1. enter a ticker symbol

Failing at finance has never been easier.

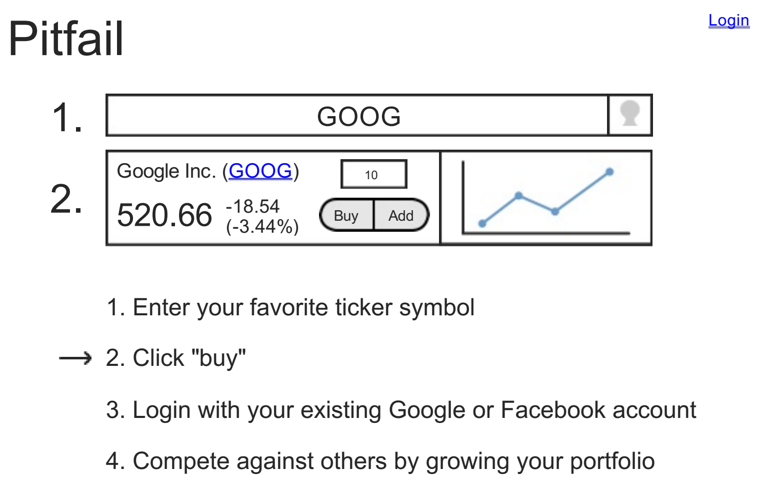
⟶ 1. Enter your favorite ticker symbol

2. Click "buy"

3. Login with your existing Google or Facebook account

4. Compete against others by growing your portfolio

Assuming the ticker symbol exists, the PitFail slogan is replaced with a stock quote that indicates the stock's market value. The user then chooses how many shares he or she wishes to purchase and clicks the "buy" button to confirm the purchase (this process of purchasing a stock is described in more detail when discussing the portfolio page):



Pitfail

Login

1. GOOG

2. Google Inc. (GOOG) 10

520.66 -18.54 (-3.44%) Buy Add

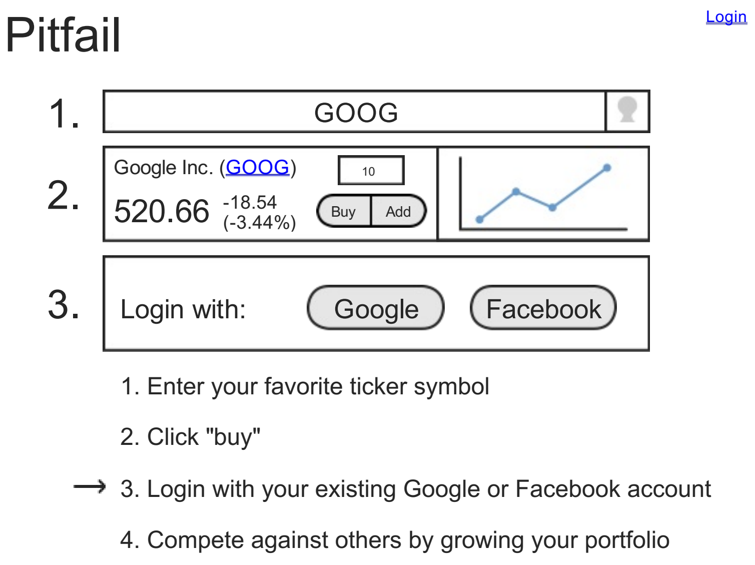
1. Enter your favorite ticker symbol

⟶ 2. Click "buy"

3. Login with your existing Google or Facebook account

4. Compete against others by growing your portfolio

After the user clicks "buy" he or she is prompted to login using OAuth, OpenID, or Facebook Connect. Single-click login buttons are provided for most common providers, such as Facebook, Google, and Twitter:


Pitfail

Login

1. GOOG

2. Google Inc. (GOOG) 10

520.66 -18.54 (-3.44%) Buy Add

3. Login with: Google Facebook

1. Enter your favorite ticker symbol

2. Click "buy"

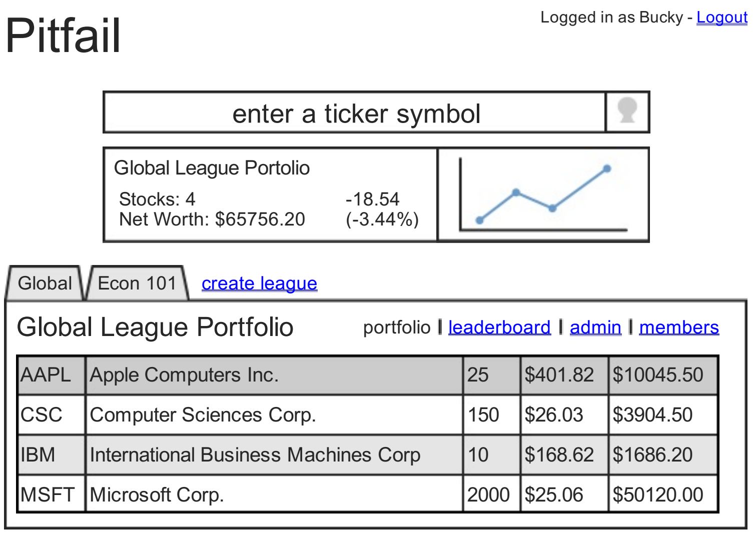
→ 3. Login with your existing Google or Facebook account

4. Compete against others by growing your portfolio

Once authentication is complete the user's PitFail account has been initialized and the stock has been purchased. This account creation is completely transparent to the user and no personal information is required to complete the login process. From this point forward, new users and returning users are treated identically.

10.1.2 Portfolio Management

Now logged in, the user is redirected to his or her Global League portfolio page. The portfolio page is the heart of the PitFail website and serves as a portal to the rest of the website and is split into three sections: (1) controls to buy/sell securities, (2) league controls, and (3) an overview of the securities in the current portfolio:


Pitfail

Logged in as Bucky - Logout

enter a ticker symbol

Global League Portolio

Stocks: 4 -18.54

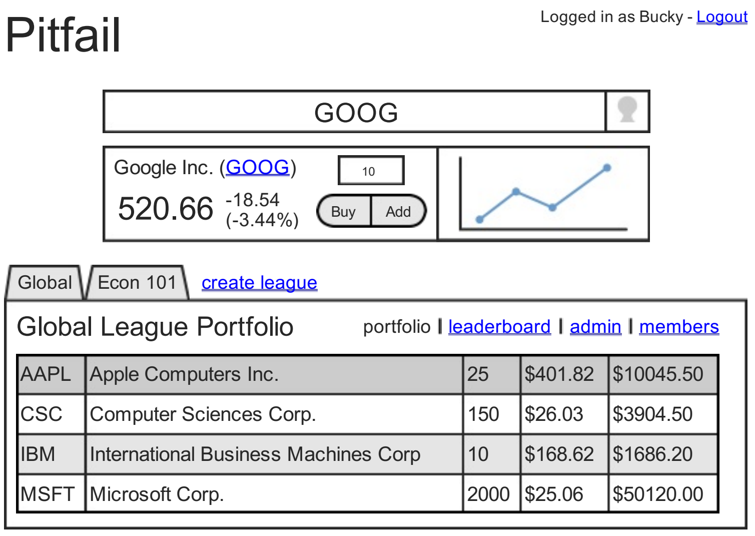
Net Worth: $65756.20 (-3.44%)

Global | Econ 101 | create league

Global League Portfolio portfolio | leaderboard | admin | members

AAPL	Apple Computers Inc.	25	$401.82	$10045.50
CSC	Computer Sciences Corp.	150	$26.03	$3904.50
IBM	International Business Machines Corp	10	$168.62	$1686.20
MSFT	Microsoft Corp.	2000	$25.06	$50120.00

Much like when completing the guided account creation process, users can purchase shares of a stock at market price by entering a ticker symbol in the large search box near the top of the page. This displays a stock quote for the requested company and displays the fields necessary to purchase the stock:


Pitfail

Logged in as Bucky - Logout

GOOG

Google Inc. (GOOG) 10

520.66 -18.54 (-3.44%) Buy Add

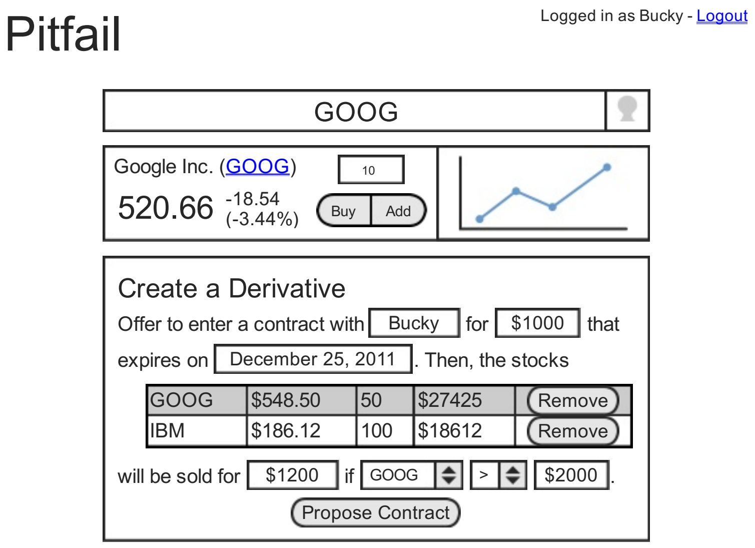
Global | Econ 101 | create league

Global League Portfolio — portfolio | leaderboard | admin | members

AAPL	Apple Computers Inc.	25	$401.82	$10045.50
CSC	Computer Sciences Corp.	150	$26.03	$3904.50
IBM	International Business Machines Corp	10	$168.62	$1686.20
MSFT	Microsoft Corp.	2000	$25.06	$50120.00

The user completes the purchase by entering a number of shares or dollar amount into the text field and clicking the "buy" button. Similarly, the user can sell shares at market price by using the same input technique in the table row that corresponds to the stock that he or she wishes to sell (not pictured due to space constraints).

Alternatively the user could click the "add" button to begin creating a derivative. This stock is added to the table and the user can continue to add stocks until he or she is satisfied. Once the user is done adding stock(s), he or she "fills in the blanks" in a description of the derivative. Once the offer is complete the potential buyer is prompted to accept the offer. This interface is easy-to-use and gives the user a better understanding of how derivatives function on the real stock market:


Pitfail

Logged in as Bucky - Logout

GOOG

Google Inc. (GOOG) 10

520.66 -18.54 (-3.44%) Buy Add

Create a Derivative

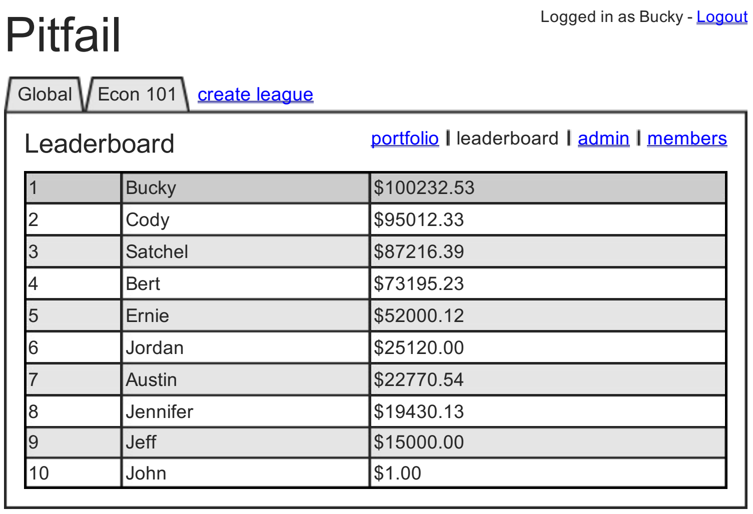
Offer to enter a contract with Bucky for $1000 that expires on December 25, 2011. Then, the stocks

GOOG	$548.50	50	$27425	Remove
IBM	$186.12	100	$18612	Remove

will be sold for $1200 if GOOG > $2000.

Propose Contract

Users that are members of multiple portfolios (e.g. students, teachers) can switch between their portfolios using the tabs near the top of the page. All actions, including buying/selling securities, only apply to the currently selected portfolio. Besides managing his or her own portfolio, each user can also view the current league's leader board:

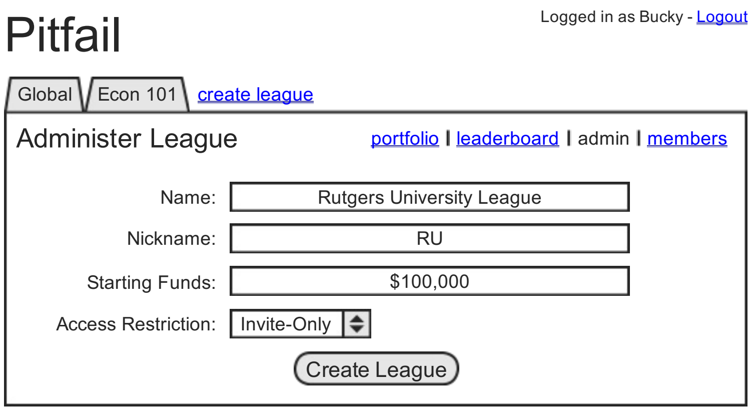

Pitfail
Logged in as Bucky - Logout
Global
Econ 101
create league
Leaderboard
portfolio | leaderboard | admin | members

1	Bucky	$100232.53
2	Cody	$95012.33
3	Satchel	$87216.39
4	Bert	$73195.23
5	Ernie	$52000.12
6	Jordan	$25120.00
7	Austin	$22770.54
8	Jennifer	$19430.13
9	Jeff	$15000.00
10	John	$1.00

The leader board shows a list of all users in the current league ranked by the current net worth of their portfolios. This encourages friendly competition and a provides a natural portal for the addition of social features in future versions.

10.1.3 League Coordination

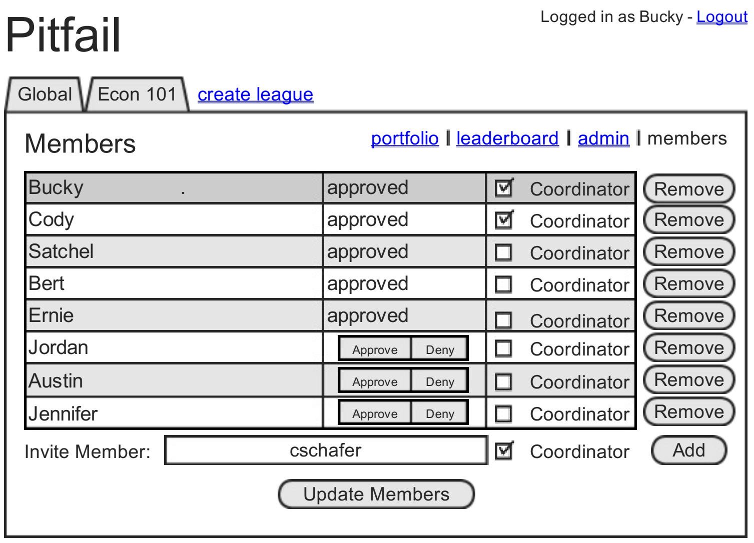
Besides the league-dependent "portfolio" and "leader board" links, there are two contextual links that are only visible to league coordinators. First, the league administration page allows league coordinators to change league-wide preferences:


Pitfail
Logged in as Bucky - Logout
Global
Econ 101
create league
Administer League
portfolio | leaderboard | admin | members
Create League

Name:	Rutgers University League
Nickname:	RU
Starting Funds:	$100,000
Access Restriction:	Invite-Only

These preferences include the league's name, nickname (used in places where the full name would be too long), starting funds, and access restriction preferences. An identical form is used for league creation.

Second, the league coordinator has access to tools necessary to manage the league's members. This includes inviting new members, removing members, and promoting existing members to league coordinator status:



Pitfail

Logged in as Bucky - Logout

Global | Econ 101 | create league

Members

portfolio | leaderboard | admin | members

Bucky	approved	☑ Coordinator	Remove
Cody	approved	☑ Coordinator	Remove
Satchel	approved	☐ Coordinator	Remove
Bert	approved	☐ Coordinator	Remove
Ernie	approved	☐ Coordinator	Remove
Jordan	Approve / Deny	☐ Coordinator	Remove
Austin	Approve / Deny	☐ Coordinator	Remove
Jennifer	Approve / Deny	☐ Coordinator	Remove

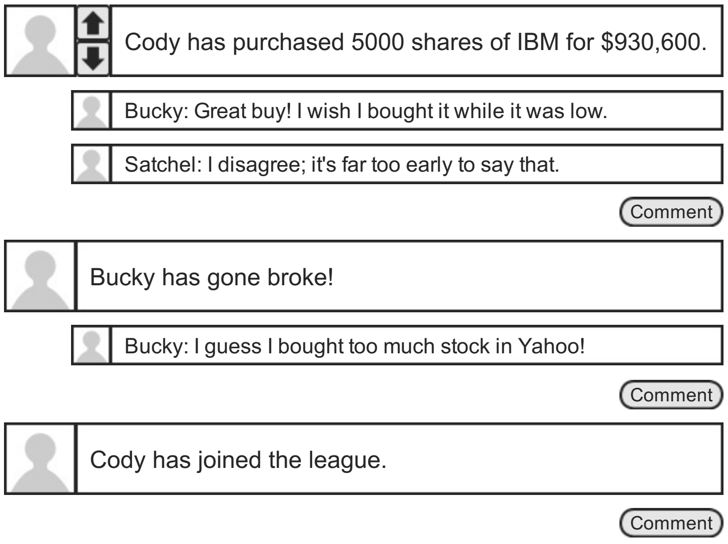
Invite Member: cschafer ☑ Coordinator Add

Update Members

This page is particularly important for invite-only leagues, such as those used by teachers. League coordinators are presented with a comprehensive list of current members and a queue of pending join requests that are awaiting approval.

10.1.4 Social Features

One of the differentiating features of the PitFail website is the tight integration of social features. The bottom of each page contains a league-specific newsfeed, similar to those found on Facebook or Github:



Cody has purchased 5000 shares of IBM for $930,600.

Bucky: Great buy! I wish I bought it while it was low.

Satchel: I disagree; it's far too early to say that.

Comment

Bucky has gone broke!

Bucky: I guess I bought too much stock in Yahoo!

Comment

Cody has joined the league.

Comment

This displays a live, real-time stream of events presented sorted in reverse-chronological order. These events include when a league member (1) joins the league, (2) goes broke, (3) purchases a stock, (4) sells a stock, (5) creates a derivative, or (6) collects on an expiring derivative. Members of the league can post short comments in response to any of these events by clicking the "comment" button associated with the event.

Additionally, users may "up-vote" or "down-vote" transactions by clicking on the arrows associated with each trade or derivative creation. These votes are used to measure the predictive accuracy of the voter. Users that correctly and reliably predict the future performance of a stock purchases or derivatives are acknowledged on the league's leaderboard.

10.2 User Effort Estimation

Several of the most common usage scenarios for the PitFail website are evaluated below. In particular, note that common scenarios (e.g. buying a stock) are much easier to perform than rare scenarios (e.g. creating a new league):

Usage Scenario	**Clicks**	**Keystrokes**
purchase a stock	5	7
create a derivative	2	27
sell a stock	5	2
create a new league	4	19
modify an existing league	5	4
invite a user to a league	6	5

These usage scenarios are discussed in detail below.

10.2.1 Purchase a Stock

Assume the user wishes to purchase 10 shares of Google stock in his or her Global League portfolio. The user must:

- **Navigation:** total of three clicks, as follows

  1. Click on "login".
  2. Click on the "Global League" tab.
  3. Click on "portfolio".

- **Data Entry:** total of two clicks and seven keystrokes, as follows

  1. Click on the "enter a ticker symbol" text field.
  2. Press the keys "G", "O", "O", and "G".
  3. Press "enter" to load the quote.
  4. Press the keys "1" and "0" to specify 10 shares.
  5. Click the "buy" button to confirm the purchase.

Note that the user could press "enter" instead of clicking the "buy" button.

10.2.2 Creating a Derivative

Assume the user wishes to offer a call option to Bucky that includes 10 shares of Google stock and expires on December 25, 2011. This option costs $1000 to begin active and one can buy the shares for $10,000 if and only if the market rate for Google stock is greater than $1000 per share. The user must:

- **Navigation:** total of two clicks, as follows

1. Click on “login”.
2. Click on the “Global League” tab.

- **Data Entry:** total of 3 clicks and 27 keystrokes, as follows

1. Click on the “enter a ticker symbol” text field.
2. Press the keys “G”, “O”, “O”, and “G”.
3. Press the “enter” key to load the quote.
4. Press the keys “1” and “0” to specify 10 shares.
5. Click the “add” button to begin creating a derivative.
6. Press the “B”, “u”, “c”, “k”, and “y” keys to enter the recipient’s name.
7. Press “tab” to move to the “premium” field.
8. Press the keys “1”, “0”, “0”, and “0” to enter $1000.
9. Press “tab” to move to the “expiration date” field.
10. Press the “1”, “2”, “/”, “2”, and “5” keys to select December 25th of the current year.
11. Press “tab” to move to the “strike price” field.
12. Press the “1”, “0”, “0”, “0”, and “0” keys to enter $10000.
13. Click on the “Propose Contract” button to complete the transaction.

10.2.3 Sell a Stock

Assume the user wishes to sell 10 shares of Google stock from his or her Global League. The user must:

- **Navigation:** total of three clicks, as follows

1. Click on “login”.
2. Click on the “Global League” tab.
3. Click on the “portfolio” tab.

- **Data Entry:** total of 2 clicks and 2 keystrokes, as follows

1. Click on the text input in the row corresponding to Google.
2. Press the keys “1” and “0” to specify 10 shares.
3. Click the “sell” button to confirm the purchase.

Note that the user could press “enter” instead of clicking the “sell” button.

10.2.4 Create a New League

Assume the user wishes to create a new league named “Rutgers” with the nickname “RU”, $100,000 starting funds, and allow public access. The user must:

- **Navigation:** total of two clicks, as follows:

1. Click on “login”.
2. Click on “create league”

- **Data Entry:** total of two clicks and 19 keystrokes, as follows

1. Click on the “name” field.
2. Press the keys “R”, “u”, “t”, “g”, “e”, “r”, and “s” to enter the name.
3. Press the tab key to move to the “nickname” field.
4. Press the keys “R” and “U” to enter the nickname.
5. Press the tab key to move to the “starting funds” field.
6. Press the keys “1”, “0”, “0”, “0”, “0”, and “0” to enter $100,000.
7. Press the tab key to move to the “access restriction” field.
8. Press the down-arrow key to select “public”.
9. Click the “create league” button.

Note that the user could have selected “public” using the mouse and/or pressed “enter” instead of clicking the “create league” button.

10.2.5 Modify an Existing League

Assume a coordinator of the “Rutgers” league wishes to change the league’s nickname from “RU” to “RU1”, which he or she is a coordinator of. The user must:

- **Navigation:** total of three clicks, as follows:
  1. Click on “login”.
  2. Click on the “Rutgers” tab.
  3. Click on the “admin” link.
- **Data Entry:** total of two clicks and four keystrokes, as follows
  1. Click on the “nickname” field.
  2. Press the “backspace” key to clear the field’s contents.
  3. Press the keys, “R”, “U”, and “1” to enter the new nickname.
  4. Click on the “update field” button.

Note that the user could have pressed “enter” instead of clicking the “create league” button.

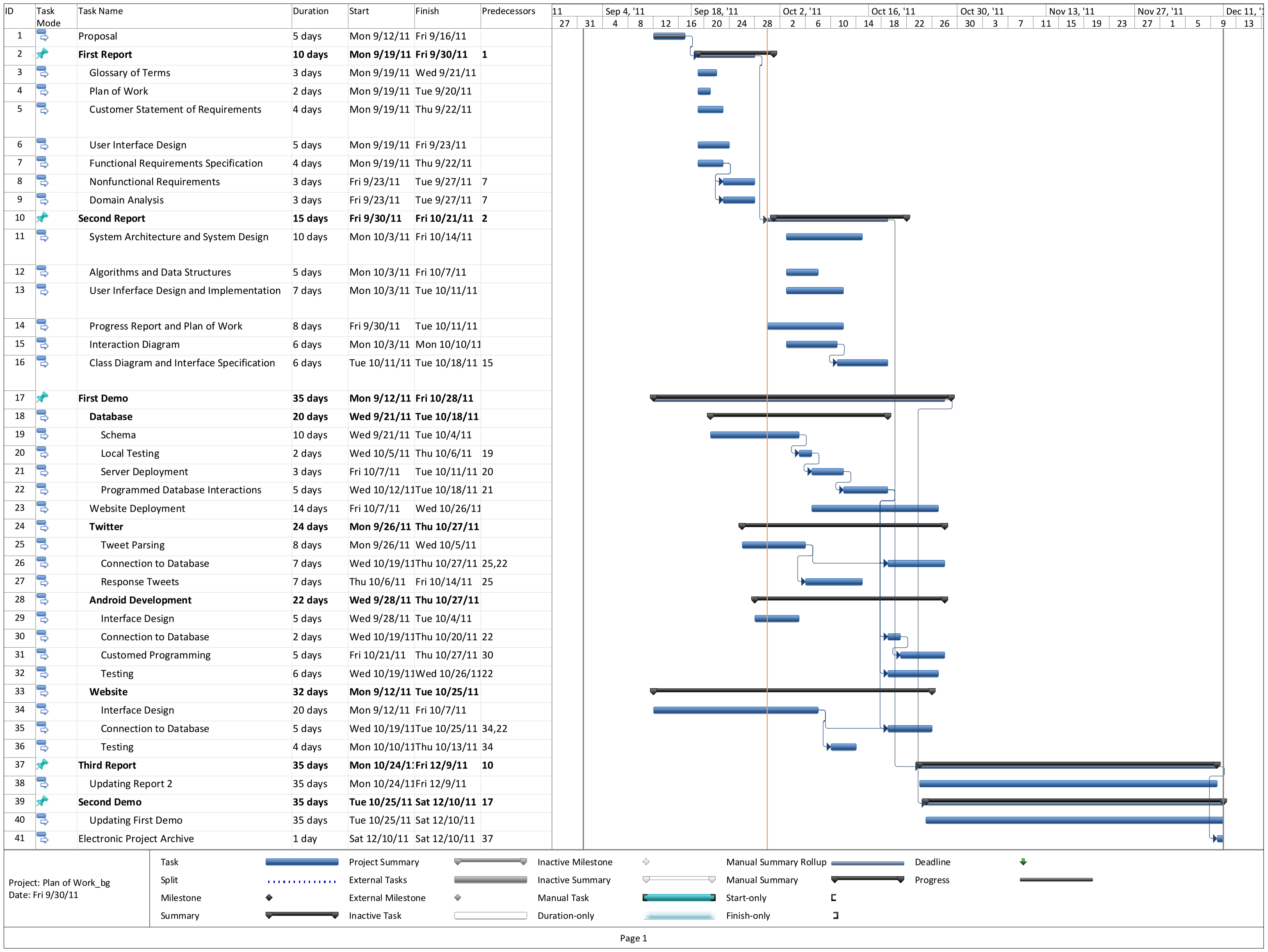
10.2.6 Invite User to a League

Assume a coordinator of the “Rutgers” league wishes to add the “Bucky” user as a coordinator of the “Rutgers” league. The user must:

- **Navigation:** total of three clicks, as follows:
  1. Click on “login”.
  2. Click on the “Rutgers” tab.
  3. Click on the “members” link.
- **Data Entry:** total of three clicks and five keystrokes, as follows
  1. Click on the “invite member” text field.
  2. Press the keys “B”, “u”, “c”, “k”, and “y” to enter the user name.
  3. Click on the “coordinator” checkbox.
  4. Click on the “add” button.

Note that the user could have pressed “enter” instead of clicking the “add” button:

11 Plan of Work



ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		Proposal	5 days	Mon 9/12/11	Fri 9/16/11	
2		**First Report**	**10 days**	**Mon 9/19/11**	**Fri 9/30/11**	**1**
3		Glossary of Terms	3 days	Mon 9/19/11	Wed 9/21/11	
4		Plan of Work	2 days	Mon 9/19/11	Tue 9/20/11	
5		Customer Statement of Requirements	4 days	Mon 9/19/11	Thu 9/22/11	
6		User Interface Design	5 days	Mon 9/19/11	Fri 9/23/11	
7		Functional Requirements Specification	4 days	Mon 9/19/11	Thu 9/22/11	
8		Nonfunctional Requirements	3 days	Fri 9/23/11	Tue 9/27/11	7
9		Domain Analysis	3 days	Fri 9/23/11	Tue 9/27/11	7
10		**Second Report**	**15 days**	**Fri 9/30/11**	**Fri 10/21/11**	**2**
11		System Architecture and System Design	10 days	Mon 10/3/11	Fri 10/14/11	
12		Algorithms and Data Structures	5 days	Mon 10/3/11	Fri 10/7/11	
13		User Inferface Design and Implementation	7 days	Mon 10/3/11	Tue 10/11/11	
14		Progress Report and Plan of Work	8 days	Fri 9/30/11	Tue 10/11/11	
15		Interaction Diagram	6 days	Mon 10/3/11	Mon 10/10/11	
16		Class Diagram and Interface Specification	6 days	Tue 10/11/11	Tue 10/18/11	15
17		**First Demo**	**35 days**	**Mon 9/12/11**	**Fri 10/28/11**	
18		**Database**	**20 days**	**Wed 9/21/11**	**Tue 10/18/11**	
19		Schema	10 days	Wed 9/21/11	Tue 10/4/11	
20		Local Testing	2 days	Wed 10/5/11	Thu 10/6/11	19
21		Server Deployment	3 days	Fri 10/7/11	Tue 10/11/11	20
22		Programmed Database Interactions	5 days	Wed 10/12/11	Tue 10/18/11	21
23		Website Deployment	14 days	Fri 10/7/11	Wed 10/26/11	
24		**Twitter**	**24 days**	**Mon 9/26/11**	**Thu 10/27/11**	
25		Tweet Parsing	8 days	Mon 9/26/11	Wed 10/5/11	
26		Connection to Database	7 days	Wed 10/19/11	Thu 10/27/11	25,22
27		Response Tweets	7 days	Thu 10/6/11	Fri 10/14/11	25
28		**Android Development**	**22 days**	**Wed 9/28/11**	**Thu 10/27/11**	
29		Interface Design	5 days	Wed 9/28/11	Tue 10/4/11	
30		Connection to Database	2 days	Wed 10/19/11	Thu 10/20/11	22
31		Customed Programming	5 days	Fri 10/21/11	Thu 10/27/11	30
32		Testing	6 days	Wed 10/19/11	Wed 10/26/11	22
33		**Website**	**32 days**	**Mon 9/12/11**	**Tue 10/25/11**	
34		Interface Design	20 days	Mon 9/12/11	Fri 10/7/11	
35		Connection to Database	5 days	Wed 10/19/11	Tue 10/25/11	34,22
36		Testing	4 days	Mon 10/10/11	Thu 10/13/11	34
37		**Third Report**	**35 days**	**Mon 10/24/1**	**Fri 12/9/11**	**10**
38		Updating Report 2	35 days	Mon 10/24/11	Fri 12/9/11	
39		**Second Demo**	**35 days**	**Tue 10/25/11**	**Sat 12/10/11**	**17**
40		Updating First Demo	35 days	Tue 10/25/11	Sat 12/10/11	
41		Electronic Project Archive	1 day	Sat 12/10/11	Sat 12/10/11	37

Project: Plan of Work_bg
Date: Fri 9/30/11

Task, Split, Milestone, Summary, Project Summary, External Tasks, External Milestone, Inactive Task, Inactive Milestone, Inactive Summary, Manual Task, Duration-only, Manual Summary Rollup, Manual Summary, Start-only, Finish-only, Deadline, Progress

Page 1

12 References

Miles, Russ and Kim Hamilton. Learning UML 2.0. Ed. Eric McLaughlin and Mary O'Brien. Sebastopol: O'Reilly, 2006.