Stocks and Options and Bonds, Oh My!
A corporation has this great idea
Capital is required to see it through

I’ll let you guess how much he wants
Option 1: Borrow the money

- From a bank
- From bonds
Option 2: Issue stocks on an exchange
Some accounting jargon

- **Assets (Capital)**
  - What is owned

- **Liabilities (Debt)**
  - What is owed

- **Equity**
  - What is left over

- **A = L + E**
  - ALE!
The stock market
What is a stock?

- A stock (a.k.a. a share) represents ownership in a company

- If there are 1,000,000 shares outstanding, and you own 1, then you own 1/1,000,000 of the company
Benefits of owning a stock

- A share of the profits upon liquidation (rarely happens)
  - Most of the time “liquidation” comes in the form of a merger

- Dividends, should the company give any out

- Voting rights in major company decisions
Stock price

- The sum of the value of each share represents the value of the whole company.
- Not all value comes from tangible items
- P/E ratio?
Some notable exchanges

- **NASDAQ**
  - $4.39 trillion in securities

- **NYSE**
  - $20.7 trillion

- **TSE**
  - $2.29 trillion
Index...es? Indices?

- Reflect how the market is doing as a whole
- Dow Jones
  - 30 leading companies
  - Each company has an equal impact
- S&P 500
  - 500 leading companies
  - Company impact weighted by the company value
- NASDAQ
  - 5,500 leading companies
  - Lots of tech stocks!
- “Points” refers to the sum of the value of the companies within
Some types of investment funds

- **Index**
  - Throw your money in, and let the market decide!

- **Mutual funds**
  - Pool your money together with other investors into a fund, let a manager invest it

- **Hedge funds**
  - Vague term, but generally they invest in markets and “hedge” out unwanted risk

- **Private Equity Firms**
  - Privately owned (usually) companies that swallow up smaller companies, boost productivity, and sell at a large profit.
Bull v.s. Bear markets
Bull v.s. Bear markets

- A Bull market is a strong market
  - Lots of jobs
  - Low inflation
  - Lots of investment

- A Bear market is the opposite
  - Few jobs
  - High inflation
  - Decreasing investment

- Depends on supply & demand, market sentiment, interest rates
Crashes!
October 1929 – Wall Street Crashes

- A hot economy, and little regulation led to lots of people “buying on the margin”
  - Borrow money and buy some shares, hope the price rises so that you can pay back the money and make a profit
  - $8.5 billion in loans were made (more than the currency
  - Speculation that prices would rise even more fuelled a bubble.
  - Buy! Buy! Buy!

- A downturn in the market caused investors to panic. This caused a snowball effect.
  - Sell! Sell! Sell!

- The market lost $30 billion in one week
- The Dow Jones was down by 90%
Dot-com bubble

- A bubble is created when a market rises quickly in value.
  - People speculate further rises and buy in anticipation
  - Herd behavior fuels more buying leading to gross overvaluing

- Dot-com’s followed a business plan of maximizing market share before making a profit

- “Get large or get lost”

- Most of these companies could never realize a serious profit, so their stocks were overpriced
Dot-com bubble

- After the March 10, 2000 weekend, the bubble burst

- One possible cause was that several multi-billion dollar sell orders from major corporations were coincidentally processed simultaneously on Monday, March 13.
Are crashes all bad?

- Well, depends on your perspective

- If you foresee a decline in a stock, you can short it. That is, bet that a stock will go down.

- This is made possible with a put option (see next slide)

- Basically get someone to agree to buy the stock at today’s price, let the price fall, buy it cheaply, and sell it at today’s price.
Options

Theoretical option price = $pN(d_1) - se^{-rt}N(d_2)$

where $d_1 = \frac{\ln(\frac{p}{s}) + (r + \frac{\sigma^2}{2})t}{\sigma \sqrt{t}}$

$d_2 = d_1 - \sigma \sqrt{t}$

The variables are:

- $p =$ stock price
- $s =$ striking price
- $t =$ time remaining until expiration, expressed as a percent of a year
- $r =$ current risk-free interest rate
- $\sigma =$ volatility measured by annual standard deviation
- $\ln =$ natural logarithm
- $N(x) =$ cumulative normal density function
It’s Friday evening! Stop showing me math!

- Options are a right to buy or sell
  - Call = right to buy
  - Put = right to sell

- For a call option:
  - Strike price $K$
  - Duration (say 1 year)
  - Current stock price $P$
Employee stock options

- Given to employees as part of a contract, or as a bonus
- If the stock falls, could be worth nothing!
- Good incentive to make employees work hard? 😊
- Actually, stocks are used a lot to generate incentives in business
A little more math... concepts

- For the buyer of the option, the downside is set (the price of the option)
- The upside is limitless
- Options are a form of risk transfer
- They can be combined in complex ways to get exactly the right amount of risk you desire, Black-Scholes tells you how to do this
- This is called financial engineering
- Options are called derivatives, they derive their value from some underlying asset (a stock)
I swear this is going somewhere

- Sounds great, case closed right?
- Underlying model assumes stock varies over time according to a Gaussian distribution (see Brownian Motion)
- In real life, they have much “fatter tails” (i.e. they crash more)
Long-Term Capital Management

- In 1994 John Meriwether, head of Bond trading at Salomon formed LTCM

- Focus was on mathematical modeling of bond prices
  - Bet on prices of similar bonds to converge over time

- All star cast included Nobel Prize winners Robert Merton and Myron Scholes (of Black-Scholes fame)

- Made 40% returns in its first few years!
From Russia with love

- As their strategy became apparent, others began to mimic

- To keep up their profits, they borrowed more money to compensate for smaller returns

- Russia devalued its currency in 1998 causing a panic across markets worldwide (what was seen as a stable investment was actually very risky... subprime mortgage??)

- People bought U.S. T-Bills to avoid risk

- Spreads didn’t converge! Bad news
So Long, Long Term

- In 1998, LTCM Lost $4.6 billion in 4 months.
- Their models predicted this scenario would only occur once in the lifetime of the universe.
Wow, so markets suck?

- I only focused on crashes because in general they’re more interesting.

- There are many examples of successful firms, and people (i.e. Warren Buffet, Google).

- In general, the best a person can do is to make informed decisions when investing.

- To see how Warren Buffet invests, go to http://www.investopedia.com/articles/01/071801.asp
Mock market!

- Each person will get 12 shares (4 each from 3 companies) and $25

- There will be 3 rounds, each round you can buy or sell shares as you like. You can also trade shares for other shares.
  - If you’re very brave, maybe try an option 😊

- Remember: The price of a share is reflected in both its current value, and possible future value (so you don’t just have to trade at the current price!).

- News flashes may occur during a round indicating late breaking information.

- The top 3 traders will win prizes!
The Companies:

- 1) CSGSA – Current share price $1
  - Tech company involved in cutting edge computational and beer-related research. Potentially worth a lot if research is successful.

- 2) Slow & Steady Motor Co. - $4
  - Well established automobile company, inventor of the velocitator and deceleratrix pedal system.

- 3) Jenron - $2
  - The world’s first conglomerate oil and gas securities traders and stylish fitness clothing retailers.
The Companies:

- **Powerthirst - $5**
  - Creator of a herb-infused caffeine-ridden extreme energy drink.

- **Volatility Inc. - $4**
  - They don’t play games, they take risks.
  - So that you don’t think I’m rigging it in any way, this one follows a random walk. Each round it has a 50/50 chance of going up or down by some dollar amount {${$1, $2, or $3}$}
  - Do you feel lucky?
## The Companies: Summary

<table>
<thead>
<tr>
<th>Company</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSGSA</td>
<td>$1</td>
</tr>
<tr>
<td>Slow &amp; Composed Motor Co.</td>
<td>$4</td>
</tr>
<tr>
<td>Jenron</td>
<td>$2</td>
</tr>
<tr>
<td>Powerthirst Beverages</td>
<td>$5</td>
</tr>
<tr>
<td>Volatility inc.</td>
<td>$4</td>
</tr>
</tbody>
</table>
Round 1

- Begin trading!
Round 1 results:

- CSGSA announces research at Koerners a complete success
- S&S profits up 2% thanks to good old fashioned advertising
- Jenron announces oil profits are up slightly, oil tycoons are more stylish than ever.
- Powerthirst linked with the illness Acute Extremenemia
## Round 1 results:

<table>
<thead>
<tr>
<th>Company</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>CSGSA</td>
<td>$5</td>
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<tr>
<td>Slow &amp; Composed Motor Co.</td>
<td>$5</td>
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<tr>
<td>Jenron</td>
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<tr>
<td>Powerthirst Beverages</td>
<td>$4</td>
</tr>
<tr>
<td>Volatility inc.</td>
<td>?</td>
</tr>
</tbody>
</table>
Round 2

- Begin trading!
News Flash!

- Free food in the 8th floor lounge!
- Work at CSGSA grinds to a halt!
Round 2 results:

- CSGSA staff pull an all nighter, work is back on track.
- Nothing new with S&S, consumers are bored
- Jenron releases their “titanic” clothing line, the irony is lost on the market and sales are good
- It turns out that Power thirst is made of Red Bull! Lawsuits are very possible!
### Round 2 results:

<table>
<thead>
<tr>
<th>Company</th>
<th>Value</th>
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<tbody>
<tr>
<td>CSGSA</td>
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<tr>
<td>Slow &amp; Composed Motor Co.</td>
<td>$4</td>
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<td>Jenron</td>
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<tr>
<td>Powerthirst Beverages</td>
<td>$2</td>
</tr>
<tr>
<td>Volatility inc.</td>
<td>?</td>
</tr>
</tbody>
</table>
Round 3

- Begin trading!
Round 3 results:

- CSGSA staff announces successful consumer trial of their new AI system: the “Brew Classifier”
- An audit of Slow & Steady shows that the company had been overstating profits for years and is actually bankrupt
- Jenron continues to rise, mostly because I said so
- Some people actually like Redbull, so sales have been fairly good for Powerthirst.
# Round 3 results:

<table>
<thead>
<tr>
<th>Company</th>
<th>Value</th>
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<tbody>
<tr>
<td>CSGSA</td>
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<td>Slow &amp; Composed Motor Co.</td>
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<td>Jenron</td>
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<tr>
<td>Powerthirst Beverages</td>
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<tr>
<td>Volatility inc.</td>
<td>$8</td>
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</tbody>
</table>
Finished!

- Tally up your results and see what your net worth is, there are prizes for the winners!