Investment Planning Group (IPG) Project Proposal

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Proposal Outline

- Background
- Problem Definition
- Preliminary Requirements
- Technical Approach
- Expected Results
- Project Plan



Options Trading Definitions

- **Derivatives**: financial instrument whose value depends on (or derives from) the values of other, more basic, underlying variables.
- **Options**: financial derivatives sold on exchanges that establishes a contract between two parties concerning the buying or selling of an asset
 - Call Option: affords the holder the *right, but not the obligation* to buy the underlying asset from the writer at the strike price, by the expiration date.
 - Put Option: affords the holder the *right* to sell the underlying asset to the writer at the strike price, by the expiration date.
 - Value of an option derives from the strike price, the spot price, interest rate, and the volatility



Definitions (cont'd)

- Strike or Exercise Price: fixed price at which the holder can purchase (if call) or sell (if put) the underlying asset from/to the writer
- **Spot or Market Price**: the settlement price of the underlying asset when an option is exercised
- **Expiration Date**: date upon which the contract expires, after which it becomes worthless if it is out of money
- **Stop Loss Order**: order to buy back an option once the price of the asset has climbed above (or dropped below) a specified *stop price*. Used to minimize catastrophic loss.
- **Slippage:** the difference between estimated filled prices and the amount actually paid, typically due to market forces.
- **Short Strangle Strategy**: selling both a put and a call option with the same expiration date but with different strike prices



Recap of Exchange and E-Mini S&P

- Exchange: platform where assets such as commodities (pork bellies, cattle, sugar, wool, lumbar, copper, aluminum, gold, tin, ...) or financial assets (currencies, treasury bonds, stock indices, ...) are traded in standardized contracts.
 - Chicago Mercantile Exchange (CME)
 - E-Mini S&P is a stock market index futures contract traded on the Chicago Mercantile Exchange's Globex electronic trading platform.
 - The notional value of one E-Mini contract is US\$50 times the value of the S&P 500 index futures.
 - E-Mini S&P futures is the underlying asset upon which our group will write options to engineer an optimal investment strategy



Options Trading Scenarios (1)



- Sell a put with strike price of 1300 and sell a call with strike price of 1350
- Stop price is ±40pts (1390 for call, 1260 for put)
- Premium for each is 10pts (each point is \$50)
- If option never stops out and expiration price is between put and call price, collected option premium is pure profit



Options Trading Scenarios (2)



- If an option stops out, which implies we buy it back to prevent further loss
 - At a cost of the difference in stop and strike price
- Both put and call stop out in this case
- Loss of 2 · 40pts 2 · 10pts (60pts)

Options Trading Scenarios (3)

- No stop loss, final price is 1280
- Only put option has value, call expires worthless
- Call makes 10pts on premium
- Put loses 10pts (cost to buy option back minus premium)

Problem Definition

Problem Definition

- Options investment strategies that are rigorously modeled are usually proprietary and are the efforts of many resources
 - Determine an optimal options investment strategy
 - Balance aggressive investment against catastrophic loss
- Sponsor's Primary Objectives
 - Extend the efforts of Fall 2009 and Spring 2010 project teams to develop a more realistic simulated trading process
 - Develop an analytical model to predict the risk reward ratio of an investment strategy and validate the strategy with our simulated trading process using real data

Preliminary Requirements

- Analyze Short Strangle Strategy writing options on E-Mini S&P futures contract
 - Selling one single pair of put and call options each option month
- Improve previous project's simulated trading process
 - Improve front-end user-interface (UI)
 - Allow user to more easily modify and prune trading strategy parameters
 - Modify simulated trading process to use more realistic assumptions
 - Bear-Call/Bull-Put spread options strategy instead of stop-loss price
 - Investigate and implement models for slippage
 - Determine optimum fractional allocation of current fund balance for writing new options contracts
 - Use premium (5-25 points) instead of strikes to parameterize writing strategies
- Implement, analyze and validate a performance prediction model to recommend the optimal investment strategy that maximizes expected profit

Technical Approach

- Extend existing Java simulated trading process GUI
 - Implement a more user-friendly front-end interface
- Improve existing simulated trading process:
 - Enumerate to find optimal Short Strangle Strategy
 - Use and improve realistic assumptions to prune search space
 - Model slippage as a function of size of trades
 - Use premium range as a parameter instead of strike price and put/call range
 - Reduce trade size when too large for market to handle
 - Use Kelly Criterion to determine optimal fractional allocation of investment
 - Marginal requirement on investment
- Implement performance prediction model(s) and recommend the optimal strategy with highest estimated profit
 - Estimate the distribution of asset prices at options expiration using Geometric Brownian Motion model
 - Estimate profit potential against feasible strategies using expected value of the asset price then select best strategy

Expected Results

- Software application
 - User-friendly Graphical User Interface
 - Improved simulated trading model
 - More realistic underlying assumptions
- Analysis on optimal, feasible fractional allocation of capital to be invested in a trade
- Recommended optimal investment strategy that maximizes expected profit based on predicted performance of various strategies
 - Analysis of implemented prediction model(s) validated against existing data
- Recommendations

Project Plan - WBS

Project Plan - Schedule

	Task Name	Duration	Start	Finish
0				
1	Management	70 days	Mon 1/31/11	Fri 5/6/11
2	Meetings	69 days	Tue 2/1/11	Fri 5/6/11
3 🖬	Team Meetings	69 days	Tue 2/1/11	Fri 5/6/11
4 📰	Sponsor Meetings	46 days	Fri 2/4/11	Fri 4/8/11
5 📰	Advisor Meetings	5 days	Fri 4/15/11	Thu 4/21/11
6	Personal Activity Logs	70 days	Mon 1/31/11	Fri 5/6/11
7	Problem Definition and Scope	9 days	Mon 1/31/11	Thu 2/10/11
8	Problem Definition and Scope Prep	9 days	Mon 1/31/11	Thu 2/10/11
9 🖬	Problem Definition Due	1 day	Thu 2/3/11	Thu 2/3/11
10	Problem Definition and Scope Due	1 day	Thu 2/10/11	Thu 2/10/11
11	Project Proposal	5 days	Fri 2/11/11	Thu 2/17/11
12	Project Proposal Prep	5 days	Fri 2/11/11	Thu 2/17/11
13 🔳	Project Proposal Due	1 day	Thu 2/17/11	Thu 2/17/11
14	Progress Reports	40 days	Fri 2/18/11	Thu 4/14/11
15	Progress Report #1	15 davs	Fri 2/18/11	Thu 3/10/11
16	Progress Report #1 Prep	15 days	Eri 2/18/11	Thu 3/10/11
17	Progress Report #1 Due	1 day	Thu 3/10/11	Thu 3/10/11
18	Progress Report #2	25 dave	Fri 3/11/11	Thu 4/14/11
19 22	Progress Report #2 Prep	25 days	Eri 3/11/11	Thu 4/14/11
20	Progress Report #2 Due	1 day	Thu 4/14/11	Thu 4/14/11
21	Final Report	12 dave	Eri 4/15/11	Mon 5/2/11
22	Final Report Prep	12 days	Eri 4/15/11	Mon 5/2/11
23	Final Report Due	1 day	Mon 5/2/11	Mon 5/2/11
24	Project Website	15 dave	Eri 4/15/11	Thu 5/5/11
25	Project Website Pren	15 dave	Fri 4/15/11	Thu 5/5/11
26	Project Website Due	1 dev	Thu 5/5/11	Thu 5/5/11
27	Final Presentation	16 dave	Fri 4/15/11	Eri 5/6/11
28	Final Presentation Pren	16 days	Eri //15/11	Eri 5/6/11
20	Dor Run #1	1 dou	Thu 4/10/11	Thu 4/29/44
29	Dry Run #2	1 day	The 5/5/44	The 5/5/44
30	Dry Run #2	1 day	Thu 5/5/11	Thu 5/5/11
31	r Inal Presentation	1 day	Fri 5/6/11	Fri 5/6/11
32	Research	40 days	Mon 1/31/11	Fri 3/25/11
33	Background	40 days	Mon 1/31/11	Fri 3/25/11
34	Financial Investing	20 days	Mon 1/31/11	Fri 2/25/11
35	Options Trading	20 days	Mon 1/31/11	Fri 2/25/11
36	Short Strangle Strategy	20 days	Mon 2/7/11	Fri 3/4/11
37	Performance Prediction Models	20 days	Mon 2/28/11	Fri 3/25/11
38	Review Previous Projects' Efforts	20 days	Mon 1/31/11	Fri 2/25/11
39 📰	Review Previous Project's Software	20 days	Mon 2/7/11	Fri 3/4/11
40	Modeling and Simulation	55 days	Mon 2/7/11	Fri 4/22/11
41	Technical Approach	15 days	Mon 2/7/11	Fri 2/25/11
42	Model Developtment	15 days	Mon 2/21/11	Fri 3/11/11
43	Software Development	45 days	Mon 2/21/11	Fri 4/22/11
44	Improve UI Front End	15 days	Mon 2/21/11	Fri 3/11/11
45	Make Assumption More Realistic	25 days	Mon 2/28/11	Fri 4/1/11
46	Implement Kelly Criterion	10 days	Mon 3/14/11	Fri 3/25/11
47	Implement Prediction Model(s)	25 days	Mon 3/21/11	Fri 4/22/11
48	Analysis	52 days	Mon 2/21/11	Tue 5/3/11
49	Input Data Analysis	10 days	Mon 2/21/11	Fri 3/4/11
50 💼	Model Analysis	20 days	Mon 2/21/11	Fri 3/18/11
51	Results Analysis	40 days	Mon 2/28/11	Fri 4/22/11
52	Post-processing	40 days	Mon 2/28/11	Fri 4/22/11
53 📰	Visual Analysis in UI	35 days	Mon 3/7/11	Fri 4/22/11
54	Compare to Previous Year's Results	15 davs	Mon 3/7/11	Fri 3/25/11
55 🗊	Validate New Results	25 days	Mon 3/21/11	Fri 4/22/11
56	Recommendations	12 days	Mon 4/18/11	Tue 5/3/11

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References

- Chen, Tony, et. al (2010). Optimal Options Investment Strategy Final Report. Retrieved Tuesday, February 1, 2011. http://ite.gmu.edu/~klaskey/OR680/MSSEORProjectsSpring10/Investment/files/in vestment-allocation-may-2010.pdf
- Adamson, Erik, et. al (2009). *Investment Strategy Analysis*. Retrieved Tuesday, February 1, 2011. http://seor.gmu.edu/projects/SEOR-Fall09/ISG/Investment_Optimization/Deliverables_files/Investment%20Stragegy %2012142009.ppt
- Hull, J. C. (2009). *Option, Futures, and other Derivatives*. Upper Saddle River, New Jersey: Pearson Education, Inc.
- *Options (Finance).* (2011 February Thursday, 16). Retrieved Thursday, February 16, 2011 from wikipedea.org: http://en.wikipedia.org/wiki/Option_(finance)
- *E-Mini S&P*. (2011, February Wednesday, 09). Retrieved Wednesday February 9, 2011 from wikipedea.org: http://en.wikipedia.org/wiki/E-mini_S&P

