CMSC 5718 Introduction to Computational Finance

Optional Assignment (maximum 5% of total grade)

Instructions

1) This is an **optional exercise**, and any marks that you get will be treated as a bonus to your total marks from all the other assignments and the final examination. The maximum mark of this assignment will be equivalent to 5% of the final grade of the whole course, which is roughly equivalent to an improvement of a minor grade (e.g. from B+ to A-).
2) The format of these questions is similar to the problems that you will see in the final examination (but don't expect you will see the same questions in the examination).
3) If you want to submit answers, send your work by email to klchau@cuhk.edu.hk **on or before March 16, 2017, 11:59pm.**

1. Performance evaluation (20 marks)

The following table provides the historical return of a portfolio of US stocks (Portfolio A), together with data of the market return (S&P 500) and the risk free asset R_f:

	Return R	Standard deviation of return	Beta
Portfolio A	5.5%	15%	0.60
S&P 500 index	7%	11%	1.00
Risk free asset R_f	2%	n/a	n/a

Calculate the Sharpe and Treynor measures for Portfolio A and the S&P 500 index. Briefly explain the relative performance of Portfolio A compared to the S&P500 index based on each ratio.

2. Equity Portfolio Management (20 marks)

John has just started his job as an equity analyst. His first task was to analyze the attractiveness of Company A. After some research, he came up with the following fundamental information about the company and the market.

Sector:	Public utility company in Hong Kong
Estimated beta β:	0.7
Risk free rate R_f:	4.00% p.a.
Return of market portfolio R_m:	8.50% p.a.
Current stock price:	\$50
Current earnings per share (EPS):	\$6

i. What is the expected return of the stock as indicated by CAPM?
ii. Assume that EPS would grow 6% in the coming year and the expected P/E ratio after one year = 8.4, what is the expected share price after one year?
iii. Assume that a dividend of \$2.40 would be paid within the year and John's estimate in part (ii) is accurate. Should he recommend the stock as a "buy"? (Assume that the PV effect of dividend payment could be ignored)

3. Risk management (20 marks)

Your company is using the Value-at-risk (VAR) methodology to compute the risk of option trading positions. Currently there is only one option in the portfolio:

Number of call options:	–50,000 (negative indicates a short position)
Current stock price:	$50
Equivalent notional amount:	$–2,500,000
Strike of call option:	$50
Delta of the call option:	55%
Option maturity:	2 months
Volatility of stock σ:	25%

i. What is the VAR of the position at 99% confidence interval with a holding period of 1 day, using the delta-normal method? (assume that there are 250 trading days in one year and 99% probability = 2.33 standard deviations)

ii. After one day, there is a big move in the stock price and your position has lost more money than what is indicated by the VAR figure calculated in (i) above. Your boss demands an explanation. What is your reply?

4. Derivative Strategies (40 marks)

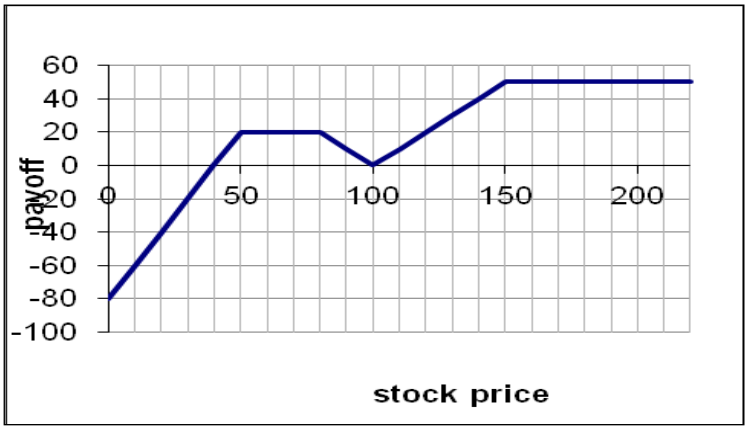
(a) *Arbitrage Strategy (20 marks)*

Describe an arbitrage strategy and calculate the profit at maturity under different scenarios of stock prices based on the following information:

Current stock price:	$100
Option maturity:	0.75 year
Interest rate:	1.99% p.a. (e^{rT} = 1.0150, e^{-rT} = 0.9852)
Dividend before option maturity:	0
Prices of options today:	Call option: $9.24; Put option: $6.77
Strike of the call and put options:	$98.5

(b) *Option strategies (20 marks)*

Construct the following payoff (at maturity) with European call and/or put options. Analyze your portfolio by dividing the possible stock price into different regions and calculate the payoffs accordingly.



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