FACULTY OF COMMERCE

DEPARTMENT OF FINANCE

BACHELOR OF COMMERCE HONOURS DEGREE IN FINANCE

PART IV 1ST SEMESTER SUPPLEMENTARY EXAMINATION–2015/6

ADVANCED ASSET PRICING THEORY AND PRACTICE [CFI4101]

TIME ALLOWED: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Answer any **FOUR (4)** questions.
2. Show all workings.
3. Write neatly and legibly.

INFORMATION TO CANDIDATES

1. This paper contains **SIX (6)** Questions.
2. Each full question carries a total of **25 marks** and part marks are indicated in brackets at the end of each part question.
3. This paper contains **SIX (6)** printed pages including the cover page.
4. Candidates may write on the question paper but shall not write in the answer booklet during reading time.

QUESTION ONE **[Total 25-marks]**

a) Discuss the risk-return trade-offs inherent in the capital asset pricing model [10-marks]

b) Consider a European call option and a European put, both with the same underlying stock, same strike price K, and same maturity time T > 0. At any time $0 \leq t \leq t$, let $S_t = S$ denote the spot price of the underlying stock, $c(S,t)$ be price of the call, and $p(S,t)$ be the price of the put at time t. Assuming constant interest rates of r , and further assuming that the underlying stock price follows and Ito process defied by $dS = \mu S dt + \sigma S dB$.

i. Show that $f(S,t) = Ke^{-r(T-t)} - S$ is a solution of the Black Sholes partial differential equation $\frac{\partial f}{\partial t} + rS\frac{\partial f}{\partial S} + \frac{1}{2}\sigma^2 S^2 \frac{\partial f}{\partial S^2} = r_f$ [5-marks]

ii. Deduce that $g(S,t) = Ke^{-r(T-t)} - S + c(S,t) - p(S,t)$ is also a solution of the Black Sholes partial differential equation. [5-marks]

iii. By assuming $t=T$, show that ii above implies that :

$$c(S,t) + Ke^{-r(T-t)} = p(S,t) + S$$ [5-marks]

QUESTION TWO **[Total 25-marks]**

You are provided with the following information regarding three assets

Security	Ticker	E(R)	Standard Deviation	Co-efficient of Variation
She	X_1	0.095	0.214	2.253
Is	X_2	0.110	0.137	1.245
Good	X_3	0.242	0.300	1.240

Correlation Matrix of Holding period returns:

	She	Is	Good
She	1.0000	-0.3965	-0.1110
Is	-0.3965	1.0000	0.5314
Good	-0.1110	0.5314	1.0000

a) Show that the risk minimising weight for asset Good in a three asset portfolio is given by

$$1 - x_s - x_t = x_G = -0.054797578$$

[20-marks]

(Recall $\sigma_p^2 \equiv x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + x_3^2\sigma_3^2 + 2x_1x_2\sigma_{1,2} + 2x_2x_3\sigma_{2,3} + 2x_1x_3\sigma_{1,3}$

b) Using your weights in a, above compare the risk (σ) for the above portfolio to a portfolio consisting of 30% She, 30% Is and 40% Good. What are your conclusions?

[5-marks]

QUESTION THREE **[Total 25-marks]**

a) Biggie Inc. is a modern traditional healing concern who has fully embraced modern technology in its herbal related medicine concern. The R and D section has a myriad of initiatives in the pipeline. One Chemical Engineering graduate from NUST has developed a concoction that is believed to deal instantly with cancer and hence the legal department has recommended the idea behind this concoction be patented. This however has become a lead candidate for a development effort because of its potential market demand. The total estimated cost to launch the product, including its development, is estimated to be $95 million. Code-named Eden it faces stiff competition, however, from other major projects in the pipeline. You are the only financial analyst in the organisation, with a recent accolade from Cambridge in Asset pricing and Stochastic processes, and decide to create a strategic abandonment option. The discounted cash flow (DCF) analysis on Eden's market potential shows that the present value of the payoff discounted at an appropriate market risk-adjusted discount rate would be $100 million. At any time during the next five years of development, based on the results, Biggie Inc. can either continue with the development effort or sell off its intellectual property for $65 million (considered the salvage value) to a strategic partner. This technology is of importance to the partner, because it can up sell it to its existing customer base. The annual volatility of the logarithmic returns of the future cash flows is calculated to be 35%, and the continuous annual riskless interest rate over the next five years is 5%. In which year from year one to year five does Biggie Inc. derive more value from exercising the abandonment option?

[15-marks]

b) Prices of stocks before stock splits show on average consistently positive abnormal returns. Is this a violation of the Efficient Market Hypothesis? [10-marks]

QUESTION FOUR **[Total 25-marks]**

a) Consider the multifactor APT with two factors. Stock A has an expected return of 17.6%, a beta of 1.45 on factor 1 and a beta of .86 on factor 2. The risk premium on the factor 1 portfolio is 3.2%. The risk-free rate of return is 5%. What is the risk-premium on factor 2 if no arbitrage opportunities exist? [5-marks]

b) Consider the multifactor APT with two factors. Stock A has an expected return of 16.4%, a beta of 1.4 on factor 1 and a beta of .8 on factor 2. The risk premium on the factor 1 portfolio is 3%. The risk-free rate of return is 6%. What is the risk-premium on factor 2 if no arbitrage opportunities exist? [5-marks]

c) . Consider a one-factor economy. Portfolio A has a beta of 1.0 on the factor and portfolio B has a beta of 2.0 on the factor. The expected returns on portfolios A and B are 11% and 17%, respectively. Assume that the risk-free rate is 6% and that arbitrage opportunities exist. Suppose you invested $100,000 in the risk-free asset, $100,000 in portfolio B, and sold short $200,000 of portfolio A. What would your expected profit from this strategy would be? [5-marks]

d) Consider the following data for a one factor-economy. All portfolios are well diversified.

Portfolio	E(R)	B
A	12%	1.2
F	6%	0.0

Suppose another portfolio, portfolio D, is well diversified with a beta of 0.6 and expected return of 8%.

i. Would an arbitrage opportunity exist? [5-marks]

ii. If, so what would be the strategy? [5-marks]

QUESTION FIVE **[Total 25-marks]**

a) According to Portfolio Theory, in the absence of a risk free asset, the optimal portfolio for a risk averse but wealth maximising investor is found at the point of tangency of the indifference curves and the efficient frontier of risky portfolios. Discuss the assumptions and practical limitations of the theory [10-marks]

b) Given that an expression of the variance of a two asset portfolio is given by :

$$\sigma_p^2 = (x_a^2\sigma_a^2 + x_b^2\sigma_b^2 + 2x_a x_b \rho_{ab}\sigma_a\sigma_b)$$

i. Show that value of x_a that minimises σ_p given that $\rho_{ab} = -1$ is given by

$$x_a = \frac{\sigma_b}{\sigma_a + \sigma_b}$$ [3-marks]

ii. Further prove that in a two asset portfolio, if $\rho_{ab} = 1$ then the expression for the standard deviation reduces to $\sigma_p = x_a\sigma_a + x_b\sigma_b$ [3-marks]

c) Consider two stocks A and B: $E(R_A) = 10$, $E(R_B) = 15$, $\sigma_A = 4, \sigma_B = 6$. If a riskless portfolio could be formed from A and B:

i. What would be the expected return of the portfolio? [3-marks]

ii. What would the expected return be if $\rho_{AB} = 0$? [3-marks]

d) Briefly explain the dominance principle in portfolio theory [3-marks]

QUESTION SIX **[Total 25-marks]**

a) You are currently in period 0. Consider the binomial option pricing model when the stock price is permitted to progress two periods into the future. The current (period 0) stock price is $100. The stock price evolves by either rising 50% or dropping by 25% each period. The risk free interest rate for each period is 10%. Assume that a European call is written on this stock with exercise price X = $120 and expiration date at the end of period 2.

   i. What are all the possible values for the stock price at the end of the first period and at the end of the second period?
   ii. Using the period 2 expiration date call option prices and stock prices, calculate the call option hedge ratio needed at end of the first period if the stock price increases in the first period.
   iii. Calculate the call option hedge ratio needed at the end of the first period if the stock price declines in the first period.
   iv. What are the call option prices applicable at the end of the first period?
   v. Calculate the period 0 call option price

b) In practice, traders usually make use of *implied volatilities in* pricing options (Hull, 2012). What is implied volatility and how can it be calculated?

[5-marks]

****END OF EXAMINATION PAPER****