FACULTY OF COMMERCE
DEPARTMENT OF FINANCE
BACHELOR OF COMMERCE HONOURS DEGREE IN FINANCE
PART IV 1ST SEMESTER EXAMINATION – DECEMBER 2015

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 FOR 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 **FIVE (5)** 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) 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 :

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

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

   [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 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	X₁	0.095	0.214	2.253
Is	X₂	0.110	0.137	1.245
Good	X₃	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

$$1 - x_s - x_i = x_G = -0.054797578$$

[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) Prices of stocks before stock splits show on average consistently positive abnormal returns. Is this a violation of the Efficient Market Hypothesis?   [12-marks]

b) You are a portfolio manager meeting a client with *Insimbi Asset Managers*. During the conversation that followed your formal review of the client's account, your client asked the following question:
   "My niece, who is studying investments, tells me that one of the best ways to make money in the stock market is to buy the stocks of small-capitalization firms late in December and to sell the stocks one month later. What is he talking about?"

   i.   *Identify* the apparent market anomalies that would justify the proposed strategy.   [8-marks]
   ii.   Explain why you believe such a strategy might or might not work in the future.   [5-marks]

QUESTION FOUR   [Total 25-marks]
a) The Arbitrage Pricing model (APT) is a better alternative to the Capital Asset Pricing model (CAPM). Discuss   [8-marks]
b) Show that for a portfolio that mimics the market portfolio $\beta_p = 1$ [5-marks]

c) Suppose that the market can be described by the following three sources of systematic risk with associated risk premiums :

Factor	Risk Premium
Industrial Production (*I*)	6%
Interest Rates (*R*)	2
Consumer confidence (*C*)	4

If the return on a particular stock is generated according to :
$$r_i = 15\% + 1.0I + 0.5R + 0.75C + \varepsilon$$

i.   Find the equilibrium rate of return on this stock using arbitrage pricing theory (APT) given that the treasury bill rate is 6%   [3-marks]
ii. Is the stock correctly priced? Explain   [2-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?   [4-marks]

    ii.   If, so what would be the strategy?   [3-marks]

QUESTION FIVE   [Total 25-marks]

a) Critically examine any three (3) limitations of the binomial option pricing method in the pricing of derivatives from the point of view of emerging markets   [6-marks]

b) Consider a European put option on a non-dividend paying stock where the stock price is $40, the risk free rate is 4% per annum, the volatility is 30% per annum, and the time to maturity is 6-months :

    i.   Calculate u, d and p for a two step binomial tree   [3-marks]

    ii.   Value the option using a two step binomial tree   [3-marks]

c) You are given the following information regarding a European call option :

Stock Price   = 47,

Strike price   = 45

Time to maturity   = 183 days

Expected price volatility = standard deviation   = 25%

Risk free rate of interest   = 10%

    i.   Calculate the value of the call option by making use of the Black-Sholes-Merton model   [3-marks]

    ii.   By making use of the put-call parity relationship, calculate the value of the put if it existed based on the information above   [3-marks]

    iii.   What two (2) critical assumptions did you make in your calculations in both i and ii above?   [2-marks]

d) 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]

QUESTION SIX   [Total 25-marks]

a) Dr. Sekuru Gudo 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, Dr. Sekuru Gudo 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 Dr. Sekuru Gudo derive more value from exercising the abandonment option?

[15-marks]

b) Use Pascal's triangle to calculate the probability that the project will be abandoned at t=4 [3-marks]

c) What advantage does real option analysis have over traditional discounted cash flow techniques and decision tree analysis? [2-marks]

d) A company is considering launching a new product onto the market. It is an unstable market and the probability of success is uncertain. However if the market conditions become favourable the company wants to have the option to expand their production by 40% at a cost of $1400. The following parameters have been estimated :

- Initial Investment $4150
- Time to Expiry 2-years
- Cost of Capital 10%
- Risk Free Interest Rate 5%

The first node for the asset value is as shown in the diagram below:
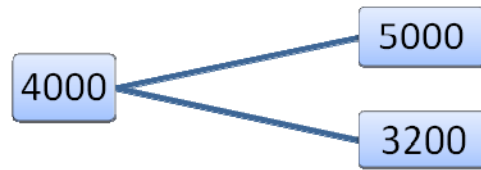
Calculate the value of the option to expand using a two-step binomial tree by backward induction. [5-marks]

END OF EXAMINATION PAPER