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CIFA PART III SECTION 6

DERIVATIVES ANALYSIS

FRIDAY: 1 December 2017. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Highlight three advantages of exchange-traded options compared to options traded in the over-the counter (OTC) market. (3 marks)

(b) (i) Define the term "futures option". (2 marks)

(ii) Argue three cases why futures options have replaced options on fixed income securities as the options vehicles of choice for institutional investors who want to use exchange-traded options. (6 marks)

(c) A four-month put futures position has a strike price of Sh.50. The risk-free rate of interest is 10% per annum. The current futures price is Sh.47.

Required:
The lower bound for the value of the futures option if it is:

(i) European futures option. (2 marks)

(ii) American futures option. (1 mark)

(d) European put and call options with an exercise price of Sh.45 is expected to expire in 115 days. The underlying asset is priced at Sh.48 and is expected to make no cash payments during the life of the options. The risk-free rate is 4.5%. The put option is selling at Sh.3.75 and the call option is selling for Sh.8.00. Assume a 365-day year.

Required:

(i) Identify the mispricing by comparing the price of the actual call with the price of the synthetic call. (2 marks)

(ii) Based on your answer in (d)(i) above, illustrate how an arbitrage transaction is executed. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) Summarise four similarities common to both options and forward contracts. (4 marks)

(b) Argue three cases for the existence of swaptions in the financial markets. (3 marks)

(c) Firm A plans to issue a Sh.100 million floating rate note today that has a 180-day term and coupon payments after every 90-days equal to the 90-day LIBOR. It plans to use a plain vanilla interest rate swap to convert this floating rate debt to a fixed rate obligation.

Firm B plans to use a swaption to hedge its future interest rate exposure and it plans to issue a Sh.100 million floating rate note in 90-days time that has a 180-day term and coupon payments every 90-days equal to the 90-day LIBOR. The firm intends to buy a European swaption with a notional principal amount of Sh.100 million and a 90-day expiry period at the time of floating rate note issuance. The firm intends to exercise the swaption if yields increase. The fixed rate on the swaption is 3.90% and, if in 90-days time the fixed rate on the underlying equivalent swap was 4.32%, the swaption will be exercised.

The following information is also provided:

LIBOR, Swap and Swaption (Rates are annualised)	**Today**	**In 90-days**
90-day LIBOR	3.50%	4.00%
180-day LIBOR	3.85%	4.35%
Fixed rate on swaption	3.90%	Not Applicable
Fixed rate on swap	Not Applicable	4.32%
90-day discount factor	0.9913	0.9901
180-day discount factor	0.9811	0.9787

Required:

(i) Determine the annualised fixed rate on the plain vanilla interest rate swap. (3 marks)

(ii) Calculate the market value of the swap at expiration. (4 marks)

(d) Susan Cheptoo is an investor who seeks to arbitrage pricing discrepancies in the market over the next six months. She has observed the following data in the market:

Instrument	**Spot Price (Sh.)**	**Futures price for contract expiring in six months (Sh.)**	**Income from Treasury Note for six months (Sh.)**	**Finance charge for six months (Sh.)**
Treasury note deliverable on the futures contract	101	100 (invoice price)	4.50	2.50

Required:

(i) Describe the process that Cheptoo would follow to carry out the arbitrage transaction. (3 marks)

(ii) Calculate the arbitrage profit, if any, that is available to exploit a possible pricing discrepancy. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) (i) Explain the term "derivative mishaps". (2 marks)

(ii) Assess five lessons that financial institutions could learn from derivative mishaps. (5 marks)

(b) A US based company that exports goods to Switzerland expects to receive payment on shipment of goods in three months time. Since the payment will be in Swiss Francs, the US company intends to hedge against a decline in the value of the Swiss Francs over the next three months.

The US risk-free rate is 2% and the Swiss risk-free rate is 5%. Assume that interest rates are expected to remain fixed over the next six months. The current spot rate is 0.5974.

Assume a 365-day year.

Required:

(i) Advise the US company whether it should use a long forward contract or a short forward contract to hedge against the currency risk. (2 marks)

(ii) Calculate the no-arbitrage price at which the US company could enter into a forward contract that expires in three months. (2 marks)

(iii) It is now 30 days since the US company entered into a forward contract. The spot rate is 0.55. Interest rates are the same as before.

Calculate the value of US company forward position. (3 marks)

(c) Peterson Mwanzia, a portfolio manager at Riora Investment Bank holds a portfolio with a total market value of Sh.105 million. Sh.65 million of this portfolio is invested in a broadly diversified portfolio of domestic equities while the remaining Sh.40 million is invested in the shares of EOBL Corporation. Mwanzia intends to reduce exposure to EOBL Corporation's shares by Sh.30 million and plans to achieve this objective by entering into a three-year equity swap using the standard and poor (S & P) 500 index.

Assume that the settlement is made at the end of each year and that one year later, EOBL share is 4% and the return on the S & P 500 market index is -3%.

Required:

(i) Explain the structure of the equity swap. (2 marks)

(ii) Calculate the net cash flow for the swap at the end of one year. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Discuss the following options strategies:

(i) Box spread. (2 marks)

(ii) Straddle. (2 marks)

(iii) Collar. (2 marks)

(iv) Bull spread. (2 marks)

(b) Omega Ltd. provides risk management consulting with regard to options and swaps for institutional and individual clients. Ann Melinda is an investment advisor for Omega Ltd. tasked to work with the firm's High Networth (HNW) client's accounts. She is considering derivative strategies for several Omega Ltd.'s clients.

Additional information:

1. SCM foundation owns 30,000 shares of Nasdaq 100 index tracking stock which has a current market price of Sh.30 per share. Ann Melinda believes that there is substantial risk of downside price movement in the index over the next six months. She has recommended that SCM foundation use a six-month collar for the entire position of 30,000 shares as a protection against the share price falling below Sh.27. The table below gives exercise prices and option premiums (per share) for the tracking stock puts and calls expiring in six months:

Tracking stock puts and calls expiring in six months

Option type	Exercise price (Sh.)	Option premium (Sh.)
Call	35	0.80
Put	27	0.95

The tracking stock index option is for 100 shares of the index tracking stock. SCM foundation plans to hold the collar strategy until expiration of the puts and call options.

2. Michael Kirwa believes that the price of large capitalisation stocks will rise slightly and he intends to profit from this movement using a bull spread strategy. Melinda recommends that Kirwa uses Dow Jones Industrial Average (DJIA) options that expire in two months. The current market price of DJIA is Sh.91. The table below gives the exercise prices and call options premium (per share) for two DJIA call options:

DJIA Call options expiring in two months

Exercise price (Sh.)	Option premium (Sh.)
88	4.40
94	1.00

The total cost of one contract is the quoted premium times the contract multiplier, which is 100 shares per contract. Kirwa decides to use 100 contracts per position.

3. James Simbili expects the tracking stock on the DJIA to trade within a narrow range around its current price. Based on his expectation, he believes that a profitable trading opportunity is to initiate a butterfly spread strategy using call options on DJIA. Melinda suggests the need to use three one-month call options on DJIA. Each option contract is for 100 shares. The table below gives exercise prices and option premiums for three DJIA call options expiring in one month.

DJIA Call options expiring in one month

Exercise price (Sh.)	Option premium (Sh.)
88	4.20
92	2.00
96	0.50

James intends to use a butterfly spread with a total of 200 long contracts and 200 short contracts.

Required:

(i) Calculate the profit from SCM foundation's collar given that the market value of index tracking is Sh.33 at expiration. (3 marks)

(ii) Calculate the maximum potential profit from SCM foundation's collar at expiration. (3 marks)

(iii) Calculate the maximum potential profit from Michael Kirwa's bull spread strategy at expiration of the DJIA call options. (3 marks)

(iv) Calculate the maximum potential loss at expiration for James Simbili's butterfly spread strategy.(3 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Evaluate three assumptions underlying the Black-Scholes-Merton (BSM) model of options valuation. (6 marks)

(b) Using the relevant options Greeks, assess how an option price, as represented by the Black-Scholes-Merton (BSM) model, is affected by a change in the value of each of the following inputs:

(i) Underlying asset price. (2 marks)

(ii) Underlying asset volatility. (2 marks)

(iii) Time-to-maturity. (2 marks)

(c) The value of a portfolio is Sh.608,000. The risk-free interest rate is 10% per annum. The value of BSE Index is 3000. The beta of the portfolio is 1.5 and the dividend yield on the index is 6% per annum. A futures contract on the BSE index with four months to maturity is used to hedge the value of the portfolio over the next three months. The futures contract is for delivery of 50 times the index. After three months, the value of the index is 2700.

Required:

(i) The minimum-variance hedge ratio. (5 marks)

(ii) The gain on short futures position at the end of three months. (3 marks)

(Total: 20 marks)

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