



**CIFA PART III SECTION 6**

**DERIVATIVES ANALYSIS**

**MONDAY: 30 November 2020**

**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) (i) Explain the meaning of the term “no-arbitrage principle” as used in derivatives markets. (2 marks)
- (ii) Highlight three assumptions of no-arbitrage principle. (3 marks)
- (b) Explain four main purpose of derivatives market in your country. (4 marks)
- (c) A company has an outstanding loan of Sh.50 million that mature's in three years. The interest rate on the loan is London Interbank Offered Rate (LIBOR) payable at the end of each year. In order to hedge against an increase in interest rate, the company enters into a swap to pay a fixed rate of 8% and receive LIBOR. In order to gain added flexibility in case the interest rate falls, the company plans to purchase a swaption with an exercise interest rate of 8.5%. The company is considering unwinding the swap at the first settlement date and that the swaption is European style. It is assumed that if the company exercises the swaption, it will do so by actually entering into the swap.

**Required:**

The net cash flows on the first settlement date assuming LIBOR if the fixed rate on the underlying swap is 7.5%.

(7 marks)

- (d) The value of a stock index is 3000. The value of an investor's portfolio is Sh.608,000. The risk-free interest rate is 10% per annum, the dividend yield on index is 6% per annum. The beta of the portfolio is 1.5. A futures contract on the stock 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. The index changes to 2700 at the end of three months.

**Required:**

Calculate the gain on short futures position.

(4 marks)

**(Total: 20 marks)**

**QUESTION TWO**

- (a) Examine five benefits of swaps as a form of derivative. (5 marks)
- (b) A Kenyan firm (KF) enters into a 3-year annual currency swap with a foreign firm (FF) with foreign currency units while the Kenyan firm has the Kenya shillings (KES) units.

The foreign currency are known as (FC). KF is the fixed rate payer and FF is the floating rate payer. The fixed interest rate at the swap initiation is 7% and 8% at the end of the swap. The variable interest rate is 5% currently, 6% at the end of year 1, 8% at the end of year 2 and 7% at the end of year 3.

At the beginning of the swap, KES 1 million is exchanged at an exchange rate of 2 FC = 1 KES. At the end of the swap period the exchange rate is 1.5 FC = 1 KES.

**Required:**

- (i) Show the payments and the party at the swap initiation. (2 marks)
- (ii) Calculate the second net swap payment at the end of year 1. (3 marks)
- (iii) At the end of the swap, determine what FF will give to KF in terms of notional principal. (2 marks)
- (iv) Demonstrate that at the end of 3 years FF pays KES 1,080,000. (2 marks)



- (c) Kassim Mohamed is a derivatives manager who is considering using option strategies to profit from his views on share prices. He collects the information given below for the listed options on the shares of Mavuno Limited which are currently trading at a price of Sh.25 per share.

	Calls	June	Expiry August	November
Strike	30	0.77	1.38	1.85
	25	1.09	3.50	4.25
	20	5.71	7.84	8.36

	Puts	June	Expiry August	November
Strike	30	5.45	5.93	6.21
	25	0.73	2.89	3.26
	20	0.53	0.93	1.23

**Required:**

Calculate the following:

- Maximum loss from a bull spread using August puts with strike prices of Sh.30 and Sh.25. (4 marks)
  - The net cost to enter a box spread using August options with strike prices of Sh.20 and Sh.25. (2 marks)
- (Total: 20 marks)**

**QUESTION THREE**

- Evaluate four factors that could determine the value of option prices. (4 marks)
  - The risk or volatility of an individual asset could be reduced either by writing a covered call option against the asset or by purchasing a put option on the asset.

**Required:**

Explain the difference in the extent to which each of these two option strategies modify an individual asset's risk. (4 marks)

- Juliet Nambuye, a derivatives analyst has been asked to value the 1-year put and call options for PKQ Limited, exercisable at Sh.49 with the underlying asset trading at Sh.49.25. Based on current estimates, in one year, the share price of PKQ Limited is expected to either move up by 15% or move down by 20%. The current risk free rate for 30 days is 3.30% per annum.

**Required:**

The value of PKQ's options using a one period binomial model. (4 marks)

- An investor owns 60,000 shares of Pelfex Limited that are currently trading at Sh.50 per share at the Securities Exchange. A call option on the company's shares with an exercise price of Sh.50 is selling at Sh.4.

Ten minutes ago, the call price was Sh.3.6 while the share price has increased by Sh.0.672 in the last 10 minutes to settle at the current price of Sh.50.

**Required:**

Determine the number of call options required to create a delta-neutral hedge for Pelfex Limited's shares. (4 marks)

- The following information relates to a long forward contract on a non-dividend paying stock entered into a few months ago:
  - The forward contract expires in six months.
  - The risk free rate is 10% per annum that is compounded continuously.
  - The stock has a price of Sh.25 per share.
  - The delivery price is Sh.24.

**Required:**

The value of the forward contract. (4 marks)

**(Total: 20 marks)**



#### QUESTION FOUR

(a) Assess four salient differences between a futures contract and a forward contract.

(4 marks)

(b) Craft Brewers Ltd. intends to carry out the following transactions in the coming months:

1. Issue a loan note of 30 million U.S dollars (USD) in three months (90 days) time. The note will have a six month (180 days) term. These proceeds will be used to meet the working capital requirements of the company.
2. Receive new capital injection of 90 million British pounds (GBP). This will occur in eight months (244 days time).

The company reports in euros (EUR).

Hassan Ndegwa, the treasury manager decides to hedge the interest rate exposure on the U.S borrowing with a forward rate agreement (FRA) and also hedge the conversion of pounds to euros.

Using the information below and a 30/360 day count, Hassan Ndegwa calculates the FRA rates implicit in the term structure. A large investment bank offers Craft Brewers Ltd. a FRA rate of 4.68% for the USD 30 million note in three months time.

#### Current term structure of USD LIBOR rates (annualised)

Term (Days)	Rate (%)
30	3.10
60	3.40
90	3.71
180	3.99
270	4.12
360	4.22

Hassan analyses the GBP per Euro (EUR) exchange rate using the data below:

#### Interest rate and exchange rate data:

United Kingdom interest rate*	4.17%
Euro interest rate*	3.28%
Spot exchange rate (GBP per EUR)	0.6892

\* 244 days interest rate, discrete and annualised

A year has 365 days

#### Required:

- (i) Calculate the six month FRA rate three months from now, implicit in the current term structure of USD LIBOR rates. (4 marks)
- (ii) Using a 180 day spot rate of 4.48% at expiration of the FRA, calculate the payoff to Craft Brewers Ltd. from the FRA offered by the investment bank. (4 marks)
- (iii) Calculate the arbitrage free 244 day forward exchange rate (GBP per EUR). (4 marks)

(c) The Treasury bond futures price is Sh.101.375. An investor is considering the following four bonds:

Bond	Price (Sh.)	Conversion factor
1	125.15625	1.2131
2	142.46875	1.3792
3	115.96875	1.1149
4	144.06250	1.4026

#### Required:

Determine the cheapest to deliver bond.

(4 marks)

(Total: 20 marks)



## QUESTION FIVE

(a) Distinguish between the following derivatives market terms:

- (i) "Maintenance margin requirement" and "variation margin requirement". (2 marks)
- (ii) "Position trader" and "scalper". (2 marks)
- (iii) "Contango" and "normal backwardation". (2 marks)

(b) The standard deviation of monthly changes in the spot price of gold is 1.2. The standard deviation of monthly changes in the futures price of gold for the closest contract is 1.4. The correlation between the futures price changes and the spot price changes is 0.7. It is now November 15. An ornament maker is committed to buying 200,000 units of gold on December 15. The ornament maker wants to use the January gold futures contract to hedge its risk.

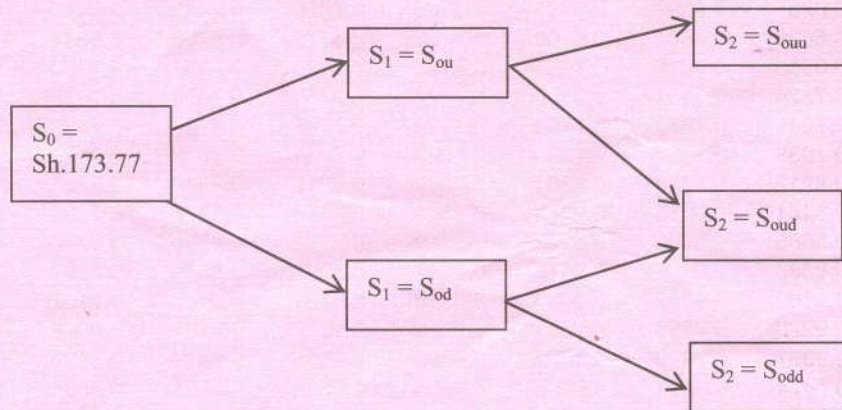
### Required:

Describe the strategy that the ornament maker should follow.

(3 marks)

(c) An analyst would like to price an option for Kimbo Ltd. which does not currently pay any dividend. Kimbo Ltd's shares currently trade at Sh.173.77 at the Securities Exchange.

The price is expected to move as shown in the following diagram over the next 2 years:



$$u = 130\%, d = 80\%$$

The analyst is looking at valuing a 2 year American put option with a strike price of Sh.180 using a two period binomial calculation. The risk free rate is currently 4.2% per annum.

### Required:

Calculate the value of Kimbo Ltd's put option using the two period binomial model.

(7 marks)

(d) An asset manager has short equity forward exposure over the Nairobi Securities Exchange (NSE) index. The forward contract was entered during the past quarter at a forward price of Sh.2,240.28 and it matures in 127 days.

The following rates and prices are current at the end of the quarter:

- NSE index is at 2,231.72.
- Continuously compounded risk free rate is 4.87% per annum.
- Continuously compounded dividend yield on the index is 3.08% per annum.

### Required:

Calculate the end of quarter value of the NSE Index equity forward to the asset manager.

Assume the year has 365 days.

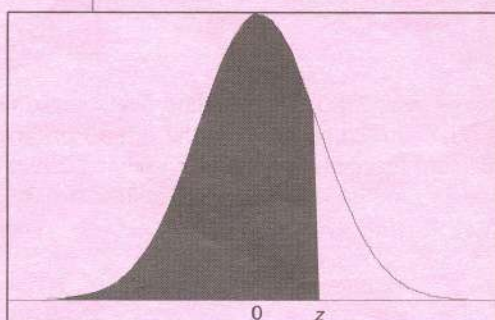
(4 marks)

(Total: 20 marks)

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# Cumulative Probabilities for the Standard Normal (Z) Distribution



Values in the table correspond to the area under the curve of a standard normal random variable for a value at or below  $z$ .

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$z$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998									
4.0	0.99997									
4.5	0.999997									
5.0	0.9999997									





**CIFA PART III SECTION 6**

**DERIVATIVES ANALYSIS**

**THURSDAY: 28 November 2019.**

**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) Your country's Securities Exchange recently introduced derivatives trading as a new strategy of expanding its product offerings:

In light of the above statement:

- (i) Describe three types of traders common in the derivatives markets. (3 marks)
- (ii) Propose three factors that could have hindered the growth of derivatives markets in developing countries. (3 marks)

- (b) Hezbon Otieno owns a dividend paying stock which is currently worth Sh.150. He plans to sell the stock in 250 days. In order to hedge against possible price decline, Hezbon decides to take a short position in a forward contract that expires in 250 days.

**Additional information:**

- 1. The risk-free rate is 5%.
- 2. Over the next 250 days the stock will pay dividends as follows:

Days to next dividend	Dividend per share (DPS) Sh.
30	1.25
120	1.25
210	1.25

- 3. Assume a 365-day year.

**Required:**

- (i) The forward price of a contract established today which expires in 250 days. (4 marks)
  - (ii) The value of the forward contract after 100 days assuming that the stock price is Sh.115 on that day. (4 marks)
  - (iii) The value of the contract at expiration assuming that the stock price is Sh.130 at expiration. (2 marks)
- (c) A bank has committed to lend Sh.25 million to a corporate borrower in 30 days. The loan will mature in 180 days and carries an interest rate of London-Interbank Offered Rate (LIBOR) plus 150 basis points.

The bank is concerned that interest rates will fall and in order to lock the lending rate, it decides to short a forward rate agreement (FRA) with an interest rate of 5.5%

**Required:**

The effective rate on the loan assuming 180 day LIBOR in 30 days is 3.25%.

(4 marks)

**(Total: 20 marks)**

## QUESTION TWO

- (a) Suggest four reasons why futures options are popular in the derivatives market. (4 marks)
- (b) Mercury Investment Limited holds an asset worth Sh.500,000. The firm intends to enter into a futures contract to sell the asset in 45 days.

### Additional information:

1. The risk-free interest rate is 8%.
2. Storage cost is Sh.22,500.
3. The future value of positive cash flow is Sh.7,500.
4. A year has 365 days.

### Required:

The appropriate futures price of the asset:

- (i) Assuming there is neither storage cost nor cash flows. (2 marks)
  - (ii) Considering storage cost only. (2 marks)
  - (iii) Considering the cash flows only. (2 marks)
  - (iv) The future price of the asset is currently trading at Sh.600,000. Show how Mercury Investment Limited could execute an arbitrage transaction assuming that the cost of carry is Sh.35,500. (4 marks)
- (c) An investment manager uses various hedging strategies. One of them is the box spread. The options have exercise prices of Sh.75 and Sh.85.

The call prices are Sh.16.02 and Sh.12.28 for exercise prices of Sh.75 and Sh.85 respectively.

The put prices are Sh.9.72 and Sh.15.18 for exercise prices of Sh.75 and Sh.85 respectively.

The options expire in 6 months. The discrete risk-free rate is 5.13%.

### Required:

- (i) Evaluate the value of the box spread and the profit at expiration. (3 marks)
  - (ii) Show that the box spread is mispriced thereby giving rise to an arbitrage opportunity. (3 marks)
- (Total: 20 marks)

## QUESTION THREE

- (a) Explain the following terms in the context of options strategies for managing equity portfolios:

- (i) Protective put. (2 marks)
- (ii) Money spread. (2 marks)
- (iii) Zero cost collar. (2 marks)

- (b) A portfolio manager believes that the market will be volatile in the near future, but does not feel particularly strongly about the direction of the movement. With this expectation, he decides to buy both a call and a put option with the same exercise price and the same expiration date on the same underlying stock trading at Sh.49. He buys one call option and one put option on this stock, both with an exercise price of Sh.50.

The premium on the call is Sh.6.25 and the premium on the put is Sh.5.875.

### Required:

- (i) The profit that the manager realises when the price of the stock at expiration is Sh.37. (3 marks)
- (ii) The maximum loss from the strategy above. (2 marks)
- (iii) The break-even stock price at expiration of the option. (2 marks)

- (c) Fanishi Limited issues a leveraged floating rate note (FRN) with a face value of Sh.5 billion that pays a coupon of 2.5 times 91 days Treasury bill rate. The company plans to generate a profit by selling the notes, using the proceeds to purchase a bond with a fixed coupon rate of 7% a year and hedging the risk by entering into an appropriate swap. A swap dealer provides a quote with a fixed rate of 6% and a floating rate of 91 days Treasury bill rate.

**Required:**

- (i) Determine the net cash flow from entering the swap. (5 marks)
- (ii) Explain two additional risks that the company might be exposed to by entering into the above swap arrangement. (2 marks)

**(Total: 20 marks)**

**QUESTION FOUR**

- (a) Assess four interest rate hedging strategies that could be used by a borrower of a variable interest rate loan. (4 marks)
- (b) The discount rates on a 60-day Treasury bill and 150-day Treasury bill are 6% and 6.25% respectively.

Assume that the Treasury bill has a Sh.1 par value and that a year has 360 days.

**Required:**

- (i) The price of a 60-day futures contract. (4 marks)
- (ii) Using suitable computations, outline the transaction that could be used to take advantage of any arbitrage opportunity assuming that the actual price of a 60-day futures contract is 0.9853. (2 marks)
- (iii) Determine the repo rate. (2 marks)
- (c) Sarah Kizito is a portfolio manager at TrueColours Asset Management firm. One of Sarah's clients has a portfolio valued at Sh.150 million that is allocated 75% to equities and 25% to bonds. Sarah wants to reduce the portfolio's equity allocation to 50% and raise its bond allocation to 50%. She intends to simultaneously lower the modified duration of the bond portfolio from 6.05 to 5.50 but leave the beta of the equity portfolio unchanged at 1.08. She will use equity index and bond futures to achieve these objectives.

Information on the relevant futures contract is as follows:

- Beta of equity index futures contract	0.95
- Price of equity index futures contract	Sh.125,000
- Modified duration of bond futures contract	7.50
- Price of bond futures contract	Sh.105,000
- The yield beta of the bond futures contract	1.00

The risk-free rate is 2.15%.

**Required:**

To achieve Sarah's portfolio objective, determine:

- (i) The number of equity index futures contract that she should sell. (3 marks)
- (ii) The number of bond futures contract that she should buy. (5 marks)

**(Total: 20 marks)**

**QUESTION FIVE**

- (a) Explain the effect of the following factors on the value of a European put option and call option price:

- (i) The underlying price. (1 mark)
- (ii) The exercise price. (1 mark)
- (iii) Time to expiration. (1 mark)
- (iv) Risk-free rate. (1 mark)
- (v) Volatility of the underlying. (1 mark)



- (b) A local pension fund has a 450,000 basis point value (BPV) duration gap with BPV of assets being less than that of liabilities. The fund uses a swap with a BPV per 100 notional of 0.2571 to construct a 50% hedge ratio. After setting up the 50% hedge, the manager forms the opinion that rates will increase and would like to benefit if his view is correct but unaffected if he is wrong.

The manager would be willing to adjust the hedge position by 15% to a 35% or 65% hedge. He checks and finds that both payer and receiver swaptions are available with a strike of 2.7%. The premiums for the payer and receiver swaptions are 55 and 75 basis points, respectively.

**Required:**

- (i) The notional principal of the 50% hedge ratio swap the manager could use. (2 marks)
- (ii) The initial cost of the swaption the manager could buy or sell to adjust his hedge to a 35% hedge. (3 marks)
- (iii) The rate on new swaps and indicate whether new rates will have to be higher or lower than the rate to make exercising the swaption profitable. (2 marks)
- (c) A one year swap with quarterly payments pays a fixed rate and receives a floating rate. The term structure at the beginning of the swap was as follows:

Lo(90)	=	0.0252
Lo(180)	=	0.0305
Lo(270)	=	0.0373
Lo(360)	=	0.0406

In order to mitigate the credit risk of the parties engaged in the swap, the swap was marked to market in 90 days. After 90 days, the swap was marked to market. The new term structure of the swap was as follows:

L90(90)	=	0.0539
L90(180)	=	0.0608
L90(270)	=	0.0653

**Required:**

- (i) The market value of the swap per Sh.1 notional principal at the beginning of the swap. (6 marks)
- (ii) The new fixed rate on the swap at which the swap would proceed after marking to market. (2 marks)
- (Total: 20 marks)
- .....





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**CIFA PART III SECTION 6**

**DERIVATIVES ANALYSIS**

**FRIDAY: 24 May 2019.**

**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 five differences between “currency exchange futures” and “forward contracts”. (5 marks)
- (b) A local company has an outstanding loan of Sh.250 million that carries a 5.15% fixed interest rate. The company anticipates that the interest rates are going to decline and enters into a one-year pay floating London Inter-bank Offered Rate (LIBOR) to receive fixed interest rate swap with quarterly payments.

The notional principal on the swap is Sh.250 million.

The current term structure of interest rates is as provided below:

Days	LIBOR (%)
90	1.42
180	1.84
270	2.12
360	3.42

45 days later, the global market experiences a financial crisis which causes interest rates to rise dramatically and the term structure of interest rates changes as shown below:

**Term structure of interest rates 45 days later**

Days	LIBOR (%)
90	2.21
180	2.62
270	3.73
360	4.92

**Required:**

- (i) The annualised fixed rate of swap entered by the local company. (4 marks)
- (ii) The market value of the swap after 45 days. (4 marks)
- (c) An investor decides to hedge a Sh.200,000 portfolio by writing index call options. The index stands at 550 and an out of the money index stock with a strike price of Sh.560 sells for Sh.800. The stock index call option hedge ratio is 0.4. The market declines by 2% which causes the price of the index option to decline to Sh.350.

**Required:**

The net gain or loss to the investor after the market decline. (5 marks)

- (d) A derivatives trader has a holding period of 2 months. The standard deviation of spot prices over the two months period is 0.18 and the volatility of the futures contract over the same period is 0.29. The correlation of the two changes in price is 0.85.

**Required:**

The optimal hedge ratio.

(2 marks)

**(Total: 20 marks)**



## QUESTION TWO

(a) Explain the impact of the following risk management strategies on a European call option:

- (i) Delta. (1 mark)
- (ii) Gamma. (1 mark)
- (iii) Vega. (1 mark)
- (iv) Rho. (1 mark)
- (v) Theta. (1 mark)

(b) Crypto Investments Limited is an oil producing company that has just negotiated a contract to sell 1 million barrels of crude oil on 15 August 2019 (assuming today is 15 May 2019).

The company is concerned about price fluctuations and is contemplating locking a favourable price by using futures contract as a hedging strategy.

The spot price on 15 May 2019 is Sh.19 per barrel and the 15 August 2019 oil futures price is expected to be Sh.18.75 per barrel. Each futures contract consists of 1,000 barrels.

### Required:

- (i) The monetary value of loss to be suffered by Crypto Investments Limited assuming prices on 15 August 2019 fall by Sh.0.01 and assuming that there is no hedging strategy. (1 mark)
  - (ii) State whether the oil producer will short or long the futures so as to hedge its position. (1 mark)
  - (iii) Determine the number of crude oil futures contract that Crypto Investments Limited would require to engage in so as to hedge its position. (2 marks)
  - (iv) Compute the total amount to be realised by Crypto Investments Limited on 15 August 2019 assuming a spot price of Sh.17.50 and assuming that the company shorts the futures position. (2 marks)
  - (v) Determine the total amount that the oil producer will realise assuming that the company decides to sell the futures contract and the spot price of crude oil turns out to be Sh.19.50 on 15 August 2019. (2 marks)
  - (vi) Comment on the results obtained in (b) (iv) and (b) (v) above. (2 marks)
- (c) John Mativo, a derivatives trader, is considering European put and call options with exercise price of Sh.45 and expiration of 115 days. The underlying price is Sh.48 and does not make any cash payment in the life of the options. The risk-free rate is 4.5%. The put is selling at Sh.3.75 while the call is selling at Sh.8.00.

### Required:

- (i) The value of the call option. (3 marks)
  - (ii) Advise the investor on whether to buy the call option based on your answer in (c) (i) above. (2 marks)
- (Total: 20 marks)**

## QUESTION THREE

(a) Prices are set to eliminate the opportunity to profit at no risk with no commitment of one's own funds.

Discuss the above statement in relation to derivatives principles referred to as the "law of one price". (6 marks)

(b) Summarise four ways of terminating a swap contract. (4 marks)

(c) John Sang is a financial and investments analyst in Telco Traders Ltd. He is concerned about the price changes of a stock that Telco Traders owns. He would also like to lock in a price at which they can sell the stock in the next 100 days.

The stock currently cost Sh.3,000 and is expected to pay dividends of Sh.40 in 15 days, Sh.40 in 85 days and Sh.50 in 175 days. The annual risk-free rate is 5% and the yield curve is flat.

Assume a 365 - day year.



**Required:**

- (i) The appropriate price that John Sang could receive in 100 days using forward contract. (2 marks)
- (ii) Assume that John Sang enters into a forward contract on the stock to sell it after 100 days, and after 60 days, the stock value is Sh.3,600.  
Determine the value of the short position in such a forward contract assuming that the risk-free rate remains unchanged. (3 marks)
- (iii) Determine the value of the forward contract assuming that the holder holds a long position and the stock price is Sh.3,800. (2 marks)

- (c) An asset is priced at Sh.50, the risk-free interests rate is 8% and a futures contract on this asset expires in 45 days. The net overall cost of carry for the underlying asset is Sh.3.55. Assume a 365-day year.

**Required:**

Advise an investor whether an arbitrage transaction exists, assuming such futures contract is trading at Sh.60.

(3 marks)

**(Total: 20 marks)****QUESTION FOUR**

- (a) A financial analyst gathered the following information relating to a stock:

Stock price	Sh.52
Strike price	Sh.50
Time to expiration	3 months
Standard deviation	20%
Interest rate (annual)	10%

**Required:**

The value of the call option using the Black-Scholes-Merton model.

(4 marks)

- (b) A financial analyst reviews an equity swap with an annual reset that a local bank entered into six months ago as the receive-fixed, pay-equity party. At the time of initiation, the underlying equity index was trading at Sh.100. Selected data regarding the equity swap which is linked to an equity index are presented below:

Swap notional amount	:	Sh.20 million
Original swap term	:	5 years with annual resets
Fixed swap rate	:	2%

The equity index is currently trading at Sh.103 and the relevant spot rate along with their associated present value factors are presented below:

Maturity (years)	Spot rate (%)	Present value factors
0.5	0.40	0.998004
1.5	1.00	0.985222
2.5	1.20	0.970874
3.5	2.00	0.934579
4.5	2.60	0.895255

**Required:**

The fair value of the equity swap from the bank's perspective.

(4 marks)

- (c) An interest rate put option based on a 90-day underlying rate has an exercise rate of 7.5% and expires in 180 days. The forward rate is 7.25% and volatility is 0.04. The continuously compounded risk-free rate is 5%.

**Required:**

The price of the interest rate put option using the Black model.

(4 marks)

- (d) A box spread consists of options on a stock trading at Sh.27.95. The options have exercise prices of Sh.25 and Sh.30 and they mature in six months. The call options for the exercise prices of Sh.25 and Sh.30 have a premium of Sh.5.30 and Sh.2.75 respectively. The put options for these exercise prices have a premium of Sh.2.00 and Sh.4.30 respectively.

**Required:**

The discrete risk-free rate assuming that the options are correctly priced.

(5 marks)

- (e) Examine three sources of gains and losses from delta hedging for a market-maker.

(3 marks)

**(Total: 20 marks)**



### QUESTION FIVE

- (a) Discuss three users of futures contracts. (3 marks)
- (b) Explain the following terms as used in derivatives markets:
- (i) Initial margin. (2 marks)
  - (ii) Maintenance margin. (2 marks)
  - (iii) Price limits. (2 marks)
- (c) Nachu PLC, a Japanese company issued a bond with a face value of ¥1,200,000,000 with a coupon rate of 5.25%. The company would like to convert this bond into a Euro-denominated bond using a swap contract. Currently, the exchange rate is ¥120/€. The fixed rate on Euro-denominated swaps is 6% and the fixed rate on Yen ¥ denominated swaps is 5%. Interest payments are done annually.

**Required:**

- (i) Describe how the swap will be executed, clearly identifying the cash flows at start. (4 marks)
  - (ii) Calculate all interest cash flows at each interest payment date. (2 marks)
  - (iii) Determine the notional principal cash flows at maturity. (2 marks)
- (d) An investor has gathered the following information on put and call options on stock:

Call price	Sh.6.64
Put price	Sh.2.75
Exercise price	Sh.30
Days to option expiration	2.9 days
Current stock price	Sh33.19

**Required:**

Put-call parity given that the stock price at expiration is Sh.20 and risk-free rate is 4%.

(4 marks)

(Total: 20 marks)

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Cumulative probabilities for POSITIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998





**CIFA PART III SECTION 6**  
**DERIVATIVES ANALYSIS**

**FRIDAY: 30 November 2018.**

**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) In relation to derivatives trading, distinguish between “forward commitments” and “contingent claims”. (2 marks)
- (b) (i) Explain the term “cross-hedging”. (2 marks)
- (ii) Argue three cases against hedging. (3 marks)
- (c) Using illustrative examples, examine two ways of writing a call option. (4 marks)
- (d) Jeremy Cheposin is an equity analyst at ABC Ltd. He believes that call options are an alternative approach to establish a long position on Triple M stock. The current market price of a six-month put option with a strike price of Sh.100 is Sh.5.35.

The risk-free interest rates are provided below:

Maturity	Risk-free interest rate (%)
3 months	0.50
6 months	0.50
1 year	1.00

**Required:**

The price of a six-month call option using the put-call parity.

(3 marks)

- (e) A stock currently trades at a price of Sh.65 and has an exercise price of Sh.60. The stock price can go up by 20% or down by 17% each period. The risk-free rate is 5%.

**Required:**

The price of a call option expiring in two periods using a two-period binomial model.

(6 marks)

**(Total: 20 marks)**

**QUESTION TWO**

- (a) Three months ago, Zuhura Ltd. purchased a European receiver swaption that is exercisable into a two-year swap with semi-annual payments. The swaption has a semi-annual exercise rate of 2.75% and a notional principal of Sh.25,000,000. The swaption has just expired.

The relevant term structure of interest rate is presented below:

Days	London Interbank Offered Rate (LIBOR)
	(%)
180	1.95
360	3.68
540	4.11
720	4.65

**Required:**

The market value of the receiver swaption.

(4 marks)

- (b) SM Bank entered into a Sh.5 million, 1 year equity swap with quarterly payments 300 days ago. The bank agreed to pay an annual fixed rate of 4% and receive the return on an international equity index. The index was trading at 3000 at the end of the third quarter, 30 days ago. The current 60-day London Interbank Offered Rate (LIBOR) rate is 3.6%. The discount factor is 0.9940 and the index is now at 3150.

**Required:**

The value of the swap to the bank.

(4 marks)

- (c) After examining its long-term liabilities, Lake Bank Limited has decided that it needs to borrow Sh.100 million over the next two years to finance its operations. For this type of funding, Lake Bank Limited issues quarterly coupon short-term Floating Rate Notes (FRN) based on 90-day London Interbank Offered Rate (LIBOR). The bank is concerned that interest rates may shift upwards and is considering using interest rate derivatives. The managers at the bank have collected quotes on the over-the-counter (OTC) interest rate caps and floors from the markets based on a notional principal of Sh.100 million.

**Interest rate caps and floors**

Term (Years)	LIBOR	Settlement	Interest rate caps		Interest rate floors	
			Rate (%)	Price (Sh.)	Rate (%)	Price (Sh.)
1	90-day	Quarterly	3.50	2,000,000	2.55	1,900,000
1	180-day	Semi-annual	3.50	2,000,000	2.55	1,900,000
2	90-day	Quarterly	3.65	2,200,000	2.70	2,090,000
2	180-day	Semi-annual	3.65	2,200,000	2.70	2,090,000

**Required:**

- (i) Explain the term "interest rate collar". (1 mark)
- (ii) The payoff from this derivative 360-days after the contract initiation assuming that the LIBOR at expiration is expected to be 3.75%. (3 marks)
- (iii) The expected payoff after 720-days from a short position in the 2-year semi-annual interest rate floor assuming that the LIBOR at expiration is expected to be 2.40% (3 marks)
- (d) On 1 March 2018, the one-month London Interbank Offered Rate (LIBOR) was 5.50% and the two-month LIBOR rate was 6.00%. The April treasury futures were quoted at 93.75. The contract size was Sh.5,000,000. The one-month LIBOR rate observed on 1 April 2018 was 7.25%.

(Assume that there is no basis risk and that one year has 360 days).

**Required:**

Determine whether an arbitrage opportunity exists.

(5 marks)

(Total: 20 marks)

**QUESTION THREE**

- (a) Assess four objectives of global regulation of derivatives market. (8 marks)
- (b) John Njoroge is a derivative consultant in New York and is working on four assignments relating to different clients.

**Client 1:**

The client manages equity portfolio for a pension fund. One month (30 days) ago, the pension fund expected a large inflow of cash in 60 days. In order to hedge against a potential rise in equity value, Njoroge advised the client to enter into a long forward contract on the S & P 500 index expiring in 60 days. The information relating to the transaction is provided below:

Price of a 60-day S & P 500 forward contract 30 days ago	1,403.22
S & P 500 index level today	1,450.82
Annualised continuously compounded risk-free rate	3.92%
Annualised continuously compounded dividend yield for S & P 500	2.50%

**Client 2:**

Three months ago (90 days), the client purchased a bond with a 5% annual coupon rate and a maturity of 7 years from the date of purchase. The bond has a face value of Sh.1,000 and pays interest every 180 days from the date of issue. As the client is concerned about the potential increase in interest rate, Njoroge advised the client to enter into a short forward contract expiring in 360 days. The annualised risk-free rate now is 4% per year and the price of the bond with accrued interest is Sh.1,071.33.



**Client 3:**

A corporate treasurer has gathered the following information:

Annualised 90 day LIBOR rate	3.2%
Annualised 450 day LIBOR rate	4.5%
Annualised risk-free rate in the United States	4.0%
Annualised risk-free rate in the Euro zone	6.0%
Spot exchange rate, USD per EUR	1.39

Three months (90 days) from now, the treasurer expects to borrow USD 5 million at LIBOR for a period of twelve months (360 days). He is concerned that interest rates may rise significantly over the next few months and wishes to hedge this risk. Njoroge advises him to enter into a forward rate agreement (FRA) expiring in 90 days on a 360 day LIBOR.

**Client 4:**

The client expects an inflow of EUR 3,000,000 that needs to be converted to United States Dollars (USD) in 270 days and is concerned that the Euro will decline in value over this period. Njoroge advises the client to enter into an agreement to sell the Euro forward in 270 days.

**Required:**

- (i) The value of the equity forward contract. (3 marks)
  - (ii) The price of the forward contract on the bond purchased. (3 marks)
  - (iii) The rate on the forward rate agreement (FRA) expiring in 90 days on 360 day LIBOR. (3 marks)
  - (iv) The forward price that the client should sell the Euros. (3 marks)
- (Total: 20 marks)**

**QUESTION FOUR**

- (a) Highlight three similarities between "forward contracts" and "futures contracts". (3 marks)
- (b) Explain the term "marking to market" as used in futures market. (2 marks)
- (c) Agva Asset Management Group (AAMG) is a pension fund management firm. One of its funds consists of Sh.300 million allocated 80% to equities and 20% to bonds. The equity portion has a beta of 1.10 and the bond portion has a duration of 6.5. AAMG would like to temporarily adjust the asset allocation to 50% equities and 50% bonds. The firm will use stock index futures and bond futures to achieve this objective. The stock index futures contract has a price of Sh.200,000 and a beta of 0.96. The bond futures contract has an implied modified duration of 7.2 and a price of Sh.105,250. The yield beta is 1.0. The transaction will be put in place on 15 November 2018, and the horizon date for termination is 10 January 2019.

**Required:**

- (i) The number of stock index futures contracts that AAMG should sell to achieve the set objective. (3 marks)
- (ii) The number of bond futures contracts that AAMG should buy to achieve the set objective. (3 marks)
- (d) Martin Opondo believes that the stock price of XYZ Ltd. will have little volatility over the next three months. He wants to construct a butterfly spread option strategy to take advantage of the opportunity he believes exists.

The following data show 3-month options which are available on XYZ Ltd.'s stock:

Option	Strike price (Sh.)	Option price (Sh.)
Put	35	1.25
Put	40	3.50
Put	45	5.50
Call	40	5.90

Martin can use any number of contracts of the above options to construct his strategy.

**Required:**

The total profit (loss) on a properly constructed butterfly spread, assuming that the price of the underlying stock at expiration is Sh.41. (4 marks)

- (e) Evans Nyongesa has recently opened a margin account in which he trades wheat futures. In July 2018, Nyongesa entered a long position of five wheat contracts, each of which covered 5,000 bushel.
- The contract price was Sh.2 and each contract required an initial margin deposit of Sh.150 and maintenance of Sh.100.
- On day 1, the price of wheat declined by Sh.0.02.
- On day 2, the price of wheat increased by Sh.0.01.
- On day 3, the price of wheat declined by Sh.0.03.

**Required:**

Determine the margin balance for this position at the end of day 3.

(5 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) James Kivuwa sells a September 2018 call on Delta Ltd.'s shares with an exercise price of Sh.45 for a Sh.3 premium. He also buys a September 2018 call on the same Delta Ltd.'s shares with an exercise price of Sh.40 for a Sh.5 premium.

**Required:**

- (i) Identify with a reason, the type of option strategy employed by James Kivuwa. (1 mark)
- (ii) Determine the maximum profit and loss for James Kivuwa. (2 marks)

- (b) An investor wishes to purchase a European put option which has the following characteristics:

Current market price of a share	Sh. 25
Strike price for a six months put option	Sh. 20
Annual standard deviation of the underlying stock	25%
Current continuously compounded risk-free rate	4.25%
$N(d_1)$	0.9737
$N(d_2)$	0.9651

**Required:**

The value of the put option using the Black-Scholes-Merton (BSM) model. (5 marks)

- (c) Josovina Investment Bank has Sh.400 million portfolio available for investment. The cost of funds is 5.5%. The bank lends 50% of the assets to domestic customers for an average annual interest rate of 7.35%. The balance of the portfolio is lent to some Ugandan clients at an annual interest rate of 8%. The spot exchange rate is KES 0.0266/UGX.

At the same time, the bank sells a forward contract to eliminate exchange rate risk equal to the expected receipts one year from now.

The forward exchange rate is KES 0.0250/UGX.

**Required:**

The net interest margin on the balance sheet of Josovina Investment Bank. (4 marks)

- (d) (i) Explain the term "swaption" in the context of derivatives. (1 mark)
- (ii) Examine three primary uses of swaptions. (3 marks)

- (e) Jedi Limited, a Japanese company issues a bond with a face value of 1.2 billion Japanese Yen (¥) and a coupon rate of 5.25%. The company is contemplating to use a swap to convert this bond into a Euro (€) denominated bond.

**Additional information:**

- The current exchange rate is ¥ 120/€.
- The fixed rate on Euro-denominated swaps is 6%.
- The fixed rate on Yen-denominated swaps is 5%.
- All payments will be made annually, so there is no adjustment such as Days/360.

**Required:**

- (i) Describe the terms of the swap between the two counter parties. (1 mark)
- (ii) Determine the cash flow at the start of the contract. (1 mark)
- (iii) Calculate all interest cash flows at each interest payment date. (2 marks)
- (iv) Calculate all principal cash flows at the maturity of the bond. (2 marks)

(Total: 20 marks)



Present Value of 1 Received at the End of  $n$  Periods:

$$PVIF_{r,n} = 1/(1+r)^n = (1+r)^{-n}$$

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091	.8929	.8772	.8696	.8621	.8475	.8333	.8065	.7813	.7576	.7353
2	.9803	.9612	.9426	.9246	.9070	.8900	.8734	.8573	.8417	.8264	.7972	.7695	.7561	.7432	.7182	.6944	.6504	.6104	.5739	.5407
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.5523	.5158	.4823	.4230	.3725	.3294	.2923
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	.5674	.5194	.4972	.4761	.4371	.4019	.3411	.2910	.2495	.2149
6	.9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5066	.4556	.4323	.4104	.3704	.3349	.2751	.2274	.1890	.1580
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	.1776	.1432	.1162
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665	.4039	.3506	.3269	.3050	.2660	.2326	.1789	.1398	.1085	.0854
9	.9143	.8368	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3606	.3075	.2843	.2630	.2255	.1938	.1443	.1084	.0822	.0628
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855	.3220	.2697	.2472	.2267	.1911	.1615	.1164	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.5847	.5268	.4751	.4289	.3875	.3505	.2875	.2366	.2149	.1954	.1619	.1346	.0938	.0662	.0472	.0340
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2567	.2076	.1869	.1685	.1372	.1122	.0757	.0517	.0357	.0250
13	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.2292	.1821	.1625	.1452	.1163	.0935	.0610	.0404	.0271	.0184
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	.0492	.0316	.0205	.0135
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394	.1827	.1401	.1229	.1079	.0835	.0649	.0397	.0247	.0155	.0093
16	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176	.1631	.1229	.1069	.0930	.0708	.0541	.0320	.0193	.0118	.0073
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978	.1456	.1078	.0929	.0802	.0600	.0451	.0258	.0150	.0089	.0054
18	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1300	.0946	.0808	.0691	.0508	.0376	.0208	.0119	.0068	.0039
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635	.1161	.0829	.0703	.0596	.0431	.0313	.0168	.0092	.0051	.0029
20	.8195	.6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	.1486	.1037	.0728	.0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	.7798	.6095	.4776	.3751	.2953	.2330	.1842	.1460	.1160	.0923	.0588	.0378	.0304	.0245	.0160	.0105	.0046	.0021	.0010	.0005
30	.7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	.0754	.0573	.0334	.0195	.0151	.0116	.0070	.0042	.0016	.0006	.0002	.0001
40	.6717	.4529	.3066	.2083	.1420	.0972	.0668	.0460	.0318	.0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001		
50	.6080	.3715	.2281	.1407	.0872	.0543	.0339	.0213	.0134	.0085	.0035	.0014	.0009	.0006	.0003	.0001				
60	.5504	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	.0001						

\* The factor is zero to four decimal places

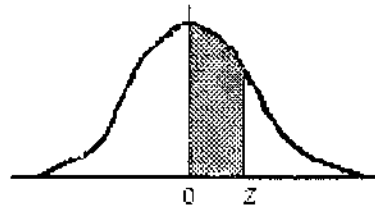
Present Value of an Annuity of 1 Per Period for  $n$  Periods:

$$PVIFA_{r,n} = \sum_{t=1}^n \frac{1}{(1+r)^t} = \frac{1 - \frac{1}{(1+r)^n}}{r}$$

Number of payments	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.6901	1.6467	1.6257	1.6052	1.5656	1.5278	1.4568	1.3916	1.3315
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4018	2.3216	2.2832	2.2459	2.1743	2.1065	1.9813	1.8684	1.7653
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.0373	2.9137	2.8550	2.7982	2.6901	2.5887	2.4043	2.2410	2.0957
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6048	3.4331	3.3522	3.2743	3.1272	2.9906	2.7454	2.5320	2.3452
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.1114	3.8887	3.7845	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.5638	4.2883	4.1604	4.0386	3.8115	3.6046	3.2423	2.9370	2.6775
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	4.9676	4.6389	4.4873	4.3436	4.0776	3.8372	3.4212	3.0758	2.7860
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3.5655	3.1842	2.8681
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.6502	5.2161	5.0189	4.8332	4.4941	4.1925	3.6819	3.2689	2.9304
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3.3351	2.9776
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.1944	5.6603	5.4206	5.1971	4.7932	4.4392	3.8514	3.3868	3.0133
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034	6.4235	5.8424	5.5831	5.3423	4.9095	4.5327	3.9124	3.4272	3.0404
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.6282	6.0021	5.7245	5.4675	5.0081	4.6106	3.9616	3.4587	3.0609
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4.6755	4.0013	3.4834	3.0764
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4456	8.8514	8.3126	7.8237	6.9740	6.2651	5.9542	5.6685	5.1624	4.7296	4.0333	3.5026	3.0882
17	15.5623	14.2919	13.1651	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.1195	6.3729	6.0472	5.7487	5.2223	4.7746	4.0591	3.5177	3.0971
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.2497	6.4674	6.1280	5.8178	5.2732	4.8122	4.0799	3.5294	3.1039
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	4.0967	3.5386	3.1090
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7.4694	6.6231	6.2593	5.9288	5.3527	4.8696	4.1103	3.5458	3.1129
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	7.8431	6.8729	6.4641	6.0971	5.4669	4.9476	4.1474	3.5640	3.1220
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.0552	7.0027	6.5660	6.1772	5.5168	4.9789	4.1601	3.5693	3.1242
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.2438	7.1050	6.6418	6.2335	5.5482	4.9966	4.1659	3.5712	3.1250
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6.6605	6.2463	5.5541	4.9995	4.1666	3.5714	3.1250
60	44.9550	34.7609	27.6756	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250

# NORMAL CURVE

AREAS  
under the  
STANDARD  
NORMAL CURVE  
from 0 to z



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z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

NOT FOR SALE





kasneb

**CIFA PART III SECTION 6**

**DERIVATIVES ANALYSIS**

**FRIDAY: 25 May 2018.**

**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) Describe two possible arrangements that could be used to settle forward contract obligations upon expiration. (4 marks)
- (b) Onyango Omamo holds an asset worth Sh.125.72 million. He wishes to raise funds and intends to sell the asset in nine months time. Onyango is concerned about the uncertainty in the price of the asset at that time. As an investment analyst specialising in derivatives, you advise Onyango to take advantage of using a forward contract by entering into such a contract to sell the asset in nine months time, which he accepts. The risk-free rate is 5.625 percent.

**Required:**

- (i) The appropriate price that Onyango Omamo could receive in nine months time using forward contract. (2 marks)
- (ii) Suppose that the counterparty to the forward contract in (b) (i) above is willing to engage in such a contract at a forward price of Sh.140 million, illustrate the type of transaction that the investor could execute to take advantage of the situation. (2 marks)
- (iii) Calculate the rate of annualised return using the information given in (b) (ii) above and explain why the transaction is attractive. (3 marks)
- (iv) Assume that the forward contract is entered into at the price computed in (b) (i) above, and two months later, the price of the asset is Sh.118.875 million. Onyango would like to evaluate his position with respect to any gain or loss accrued on the forward contract.

Determine the market value of the forward contract at this point in time from the perspective of the investor in (b)(i) above. (3 marks)

- (v) Determine the value of the forward contract at expiration assuming the contract is entered into at the price computed in (b)(i) above and the price of the property is Sh.123.50 million at expiration.

Comment on how the investor performed on the overall position of both the asset and the forward contract in terms of the rate of return. (3 marks)

**Hint:**

- Value of a forward contract at any time,  $t$ :  

$$V_t(0,T) = S_t - F(0,T)/(1 - r)^{T-t}$$
- Value of a forward contract at expiration ( $t = T$ ):  

$$V_T(0,T) = S_T - F(0,T)$$
- Value of a forward contract at initiation ( $t = 0$ ):  

$$V_0(0,T) = S_0 - F(0,T)/(1 - r)^T$$

**Where:**

- $S$  = Price of the underlying asset.  
 $F(0,T)$  = Price of the forward contract.  
 $V(0,T)$  = Value of the forward contract.  
 $r$  = Risk-free rate.  
 $T$  = Time at expiration.  
 $t$  = Time  $t$  during the life of the contract.

- (c) A corporation sold 10 million Euros against a British pound forward at a forward rate of 0.8000 GBP/Euro at time 0. The current spot rate at time  $t$  is 0.7500 GBP/ Euro and the annually compounded risk-free rates are 0.80% for the British pound and 0.40% for the Euro. Assume that at time  $t$ , there are three months until the forward contract expiration.

**Required:**

The value of the foreign exchange forward contract at time  $t$ .

(3 marks)

(Total: 20 marks)

**QUESTION TWO**

- (a) Describe the following four possible options positions:

- (i) Long call. (1 mark)
- (ii) Short call. (1 mark)
- (iii) Long put. (1 mark)
- (iv) Short put. (1 mark)

- (b) A Kenyan company enters into a currency swap in which it pays a fixed rate of 6 percent in United States dollars (\$) and the counter party pays a fixed rate of 5 percent in Kenya Shillings (Ksh.). The notional principals are Ksh.75 million and \$105 million. Payments are made semi-annually and on the basis of 30 days per month and 360 days per year.

**Required:**

- (i) The initial exchange of payments that takes place at the beginning of the swap. (2 marks)
- (ii) The semi-annual payments. (2 marks)
- (iii) The final exchange of payments that takes place at the end of the swap. (2 marks)

- (c) An investor wishes to purchase a European put option on Tausi Limited Shares. The details of the put option on Tausi Limited shares are provided below:

Time to expiration	1 year
Current market price per share	Sh.52
Exercise price per share	Sh.45
Model predicted up move	15%
Model predicted down move	20%
Annualised risk-free rate	6%

**Required:**

Using a one period binomial model, calculate the value of a one-year put option on Tausi Limited shares. (4 marks)

- (d) A Sh.30 million portfolio consists of Sh.20 million of equity with a beta of 1.15 and Sh.10 million of bonds with a modified duration of 6.25 and a yield-to-maturity of 7.15%. The portfolio manager would like to change the allocation to Sh.15 million of equity and Sh.15 million of bond. In addition, the portfolio manager would like to adjust the equity beta to 1.05 and the modified duration on the bonds to 7. Equity index futures contract has a price of Sh.225,000 and a beta of 1.0. A bond futures contract is priced at Sh.92,000 with an implied modified duration of 5.9 and an implied yield-to-maturity of 5.65%.

The portfolio manager intends to use futures to synthetically sell Sh.5 million of equity, reduce the beta on the remaining equity, synthetically buy Sh.5 million of bond and increase the modified duration on the remaining bonds. The investment horizon date is three months, after which the equity index future price is expected to be Sh.217,800 and the bond futures price is expected to be Sh.92,878. The equity portfolio declines by 3% and the bond portfolio increases by 1% in three months period.

**Required:**

The overall value of the portfolio in three months period.

(6 marks)

(Total: 20 marks)



### QUESTION THREE

- (a) Highlight four factors that could affect the price of a futures contract. (4 marks)
- (b) Peter Oteba intends to purchase a futures contract whose underlying asset is gold. The following information is provided to him:
1. The current price of gold is Sh.30,000.
  2. The net cost of carry for gold is zero.
  3. The risk-free rate is 6 percent.
  4. One year has 365 days.

**Required:**

- (i) The price of a 90-day futures contract. (2 marks)
- (ii) Illustrate how an arbitrage transaction could be executed if the futures contract is priced at Sh.30,600. (4 marks)
- (iii) Illustrate how an arbitrage transaction could be executed if the futures contract is priced at Sh.30,300. (4 marks)
- (c) A bank plans to make a Sh.10 million floating rate loan in 90 days. The loan period will be 180 days and the rate will be 180-day LIBOR plus 150 basis points. The current 90-day LIBOR is 10.5%. The bank is worried about falling interest rates over the period from now until the loan starts and decides to use an interest rate put option with an exercise price of 9% priced at Sh.5,023.

**Required:**

- The effective rate on the loan given that the LIBOR at expiration is 5%. (6 marks)
- (Total: 20 marks)**

### QUESTION FOUR

- (a) Named after its founders, Fisher Black, Myron Scholes and Robert Merton, the Black-Scholes-Merton (BSM) model earned Scholes and Merton a Nobel Prize in 1997 for developing the model, two years after the death of Fisher Black in 1995.

In relation to the above statement, discuss the five inputs of the Black-Scholes-Merton (BSM) model. (5 marks)

- (b) An interest rate call option based on a 90-day underlying rate has an exercise rate of 7.5% and expires in 180 days. The forward rate is 7.25% and volatility is 0.04. The continuously compounded risk-free rate is 5%.

Assume that the value of  $d_1$  is  $-1.1928$ .

**Required:**

The price of the interest rate call option using the Black model. (6 marks)

- (c) The current share price of ABC Ltd. is Sh.100. The shares volatility is 15%. The risk-free rate is 5% and the company pays no dividend. The strike price on the ABC shares is Sh.100.

**Required:**

Show that the put-call parity holds. (5 marks)

- (d) An option trader has the following four transactions:

Transaction	Exercise price (Sh.)
Long 1 call	95
Short 1 call	105
Long 1 put	105
Short 1 put	95

**Additional information:**

1. The stock price at expiration is Sh.102.
2. Options expire in 1 year.
3. The risk-free interest rate is 10%.

**Required:**

- (i) The value of the trader's box spread. (2 marks)
- (ii) The cost of the box spread. (2 marks)

**(Total: 20 marks)**

### QUESTION FIVE

- (a) Highlight three similarities between swap contracts and forward contracts. (3 marks)
- (b) A financial institution has entered into a 10-year currency swap with company Y. Under the terms of the swap, the financial institution receives interest at a rate of 3% per annum in Swiss Francs and pays interest at a rate of 8% in U.S. dollars. Interest payments are exchanged once a year. The principal amounts are 7 million US dollars (\$) and 10 million Swiss Francs (SFr). Company Y happens to declare bankruptcy at the end of year 6, when the exchange rate is \$0.80 per Swiss Franc. At the end of year 6, the interest rate is 3% per annum in Swiss Francs and 8% per annum in U.S. dollars for all maturities. All interest rates are quoted with annual compounding.

**Required:**

The cost of currency swap to the financial institution. (5 marks)

- (c) A currency swap has a remaining life of 15 months. It involves exchanging interest at a rate of 10% on 20 million Sterling pounds for interest rate of 6% on 30 million USD once a year. The term structure of interest rates in both the United Kingdom and the United States is currently flat, and if the swap were negotiated today the interest rates exchanged would be 4% in US dollars and 7% in Sterling pounds. All interest rates are quoted with annual compounding.

The current exchange rate (US dollar per Sterling pound) is 1.8500.

**Required:**

Determine the value of the swap to the party paying US dollars. (4 marks)

- (d) A party has entered a receive-floating 6 x 9 FRA (forward rate agreement) at a rate of 0.86% with notional amount of 10,000,000 Canadian dollars (C\$) at time 0. The six month spot C\$ LIBOR was 0.628% and the nine month C\$ LIBOR was 0.712%. The 6 x 9 FRA rate is quoted in the market at 0.86%. After 90 days have passed, the three month C\$ LIBOR is 1.25% and the six month C\$ LIBOR is 1.35%.

**Required:**

Using the appropriate discount rate, calculate the value of the original receive-floating 6 x 9 FRA. (4 marks)

- (e) A put option with an exercise price of Sh.45.00 is currently trading at Sh.3.50. The underlying share is trading at a market price per share (MPS) of Sh.45.00. The MPS is expected to increase to Sh.50.00.

**Required:**

In relation to the above statement, explain the effect of the following:

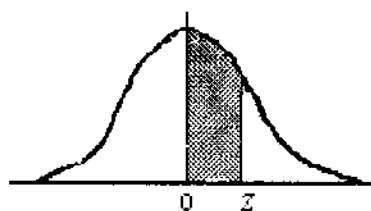
- (i) Put option's Delta. (2 marks)
- (ii) Put option's Gamma. (2 marks)

(Total: 20 marks)



# NORMAL CURVE

AREAS  
under the  
STANDARD  
NORMAL CURVE  
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

NOT FOR SALE



**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:

<b>LIBOR, Swap and Swaption (Rates are annualised)</b>	<b>Today</b>	<b>In 90-days</b>
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:

<b>Instrument</b>	<b>Spot Price (Sh.)</b>	<b>Futures price for contract expiring in six months (Sh.)</b>	<b>Income from Treasury Note for six months (Sh.)</b>	<b>Finance charge for six months (Sh.)</b>
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)**
- .....



# KASNEB

## CIFA PART III SECTION 6

### DERIVATIVES ANALYSIS

FRIDAY: 26 May 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) Argue three cases for the existence of derivatives markets in your country. (6 marks)
- (b) Justify why a portfolio manager would prefer to create a put option synthetically instead of buying it in the market. (2 marks)
- (c) Differentiate between "strip hedge" and "stack hedge" as used in derivatives trading. (2 marks)
- (d) A non-dividend paying stock has a call option. The price of the stock is Sh.49. The strike price is Sh.50. The risk free-rate is 5%. The time-to-maturity is 0.3846 years and the volatility is 20%. There are 365 days in a year.

#### Required:

- (i) The option's theta. (4 marks)
- (ii) The change in the option's delta when price increases by 10%. (2 marks)
- (iii) The change in the option's value when volatility increases to 21% from 20%. (2 marks)
- (iv) The change in the option's value when risk-free rate increases to 6% from 5%. (2 marks)

#### Hint:

$$\text{Option theta} = \frac{-S_0 N'(d_1) \sigma}{2\sqrt{T}} - rKe^{-rT} N(d_2)$$

$$\text{Option gamma} = \frac{N'(d_1)}{S_0 \sigma \sqrt{T}}$$

$$\text{Option vega} = S_0 \sqrt{T} N(d_1)$$

$$\text{Option rho} = KTe^{-rT} N(d_2)$$

$$\text{Where: } N'(d_1) = 0.40112$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

(Total: 20 marks)

#### QUESTION TWO

- (a) Discuss three factors that could affect an option's time value. (3 marks)
- (b) (i) Explain the term "interest rate cap" in relation to derivatives markets. (1 mark)
- (ii) An institution has issued a floating rate note for which the interest rate is reset after every 90 days, using the prevailing 90-day spot interest rate. The next reset date is due in 42 days' time. The institution has purchased an interest rate cap with a maturity of 42 days and cap rate of 5.50%. The amount involved is Sh.10 million. The 90-day spot interest rate at 42 days is 5.80%.

#### Required:

The pay-off to the cap. (2 marks)

- (c) Andrew Makori is a global equity manager who manages a Sh.95 million large capitalisation United States (US) equity portfolio and he is currently forecasting that equity markets will decline soon. Andrew prefers to avoid the transactions cost of making sales but intends to hedge Sh.15 million of the portfolio's current value using Standard and Poor (S & P) 500 index futures. Andrew realises that his portfolio will not track the S & P 500 index exactly. He decides to perform a regression analysis on his actual portfolio returns versus the S & P futures returns over the past year. This regression analysis will indicate a risk minimising beta of 0.88 with a coefficient of determination ( $R^2$ ) of 0.92.

**Futures Contract Data**

S & P 500 futures price	Sh.1,000
S & P 500 Index	999
S & P 500 Index multiplier	250

**Required:**

- (i) The number of futures contracts required to hedge Sh.15 million of the equity manager's portfolio. (3 marks)
- (ii) Advise Andrew Makori on three alternative methods that he should use to replicate the futures strategy. (6 marks)
- (d) A box spread consists of options with exercise prices of Sh.75 and Sh.85. The call prices are Sh.16.02 and Sh.12.28 for exercise prices of Sh.75 and Sh.85 respectively. The put prices are Sh.9.72 and Sh.15.18 for exercise prices of Sh.75 and Sh.85 respectively. The options expire in six months and the discrete risk free-rate is 5.13%.

**Required:**

- (i) The profit of the box spread at expiration. (2 marks)
- (ii) Show that this box spread is priced such that an attractive opportunity is available. (3 marks)
- (Total: 20 marks)**

**QUESTION THREE**

- (a) Explain two uses of index futures. (2 marks)
- (b) Evaluate three advantages of interest rate collar. (3 marks)
- (c) Diamond Financial Services (DFS) offers fixed income portfolio management services to institutional investors. DFS would like to execute a duration changing strategy for a Sh.150 million bond portfolio of a particular client. This portfolio has a modified duration of 8. DFS plans to change the modified duration to 6 by using a futures contract priced at Sh.150,000 which has an implied modified duration of 7. The yield beta is 1.5. After one year, the yield on the bond has decreased by 30 basis points. The bond portfolio increases in value by 1.5% and the futures price increases to Sh.152,000.

**Required:**

The overall gain on the portfolio. (3 marks)

- (d) Kemeloi Capital is a money management firm that specialises in turning the idle cash of its clients into equity index positions at very low cost. The firm has a new client with Sh.500 million of cash that it would like to invest in the small cap equity sector. Kemeloi Capital would like to construct the position using a futures contract on a small cap index.

**Additional information:**

1. The futures price is 1,500.
2. The multiplier is 100.
3. The contract expires in six months.
4. The underlying small cap index has a dividend yield of 1%.
5. The risk free rate is 3% per annum.

**Required:**

Determine how the cash could be equitised using a futures contract. (3 marks)

- (e) Melly Odhiambo, a corporate treasurer at Suneka Ltd. needs to hedge the risk of the interest rate on a future transaction. The risk is associated with the rate on the 180-day London Inter-bank Offer Rate (LIBOR) in 30 days. The relevant term structure of LIBOR is given as follows:

30 day LIBOR	5.75%
210 day LIBOR	6.15%

20 days later, interest rates are expected to move significantly downward to the following:

10 day LIBOR	5.45%
190 day LIBOR	5.95%

On the expiration day, 180 day LIBOR is expected to be 5.72%. Melly Odhiambo decides to long this forward rate agreement (FRA) for a notional principal of Sh.20 million.

**Required:**

- (i) Compute the market value of the FRA, 20 days later. (2 marks)
  - (ii) Calculate the payment to be made to or by the company so as to settle the FRA contract on its expiration. (2 marks)
- (f) John Omulundo, an investment manager, holds an asset portfolio with a total market value of Sh.105 million. The allocation of the portfolio is as follows:
- 1. Sh.65 million is invested in a broadly diversified portfolio of domestic stocks.
  - 2. Sh.40 million is invested in the stocks of Jimbo Corporation.

The investment manager wishes to reduce exposure to Jimbo Corporation stocks by Sh.30 million. The manager plans to achieve this objective by entering into a three-year equity swap using the Standard and Poor (S & P) 500 market index.

Assume that settlement is made at the end of each year and the return on S & P 500 market index is -3 percent.

**Required:**

- (i) Explain the structure of the equity swap. (2 marks)
  - (ii) Calculate the net cash flow for the swap at the end of the year. (3 marks)
- (Total: 20 marks)**

**QUESTION FOUR**

- (a) Although there is a clear similarity between forward contracts and futures contracts, critical distinctions nonetheless exist between the two.

**Required:**

In relation to the above statement, explain five differences between forward contracts and futures contracts. (5 marks)

- (b) A long forward contract on a non-dividend paying stock was entered some time ago. It has 6 months to maturity. The risk-free rate of interest with continuous compounding is 10% per annum. The stock price is Sh.25 and the delivery price is Sh.24.

**Required:**

The value of the forward contract. (3 marks)

- (c) A six-month European call option on the spot price of gold exists. The strike price is Sh.1,200. The six-month futures price of gold is Sh.1,240. The risk free-rate of interest is 5% per annum and the volatility of the futures price is 20%.

The option is the same as a six-month European option on the six-month futures price.

**Required:**

The value of the option. (4 marks)



- (d) A portfolio manager is entering into a two-year swap in which his firm will receive the rate of return on the Russell 2,000 index and will pay a fixed interest rate. The swap has annual payments. The fixed rate of the swap to be initiated is 4.99%. The Russell 2,000 index is at 757.09 at the beginning of the swap and the notional principal of the swap is Sh.100 million. One hundred days later, the Russell 2,000 index is at 723.86 and the term structure is presented below:

**Term structure of LIBOR interest rates 100 days later**

Days (T)	Lo (T)	Bo (T)
260	0.0442	0.9691
620	0.0499	0.9209

Note: Calculations are on a 360-day year basis.

Where, T = Time to expiration  
 Lo (T) = LIBOR rate to time T  
 Bo (T) = Discount factor of Sh.1 from time T to the present

**Required:**

The market value of the firm's position in the swap 100 days after the initiation of the swap. (4 marks)

- (e) Silvia Makena is concerned about the risk level of a client's equity portfolio. The client has 60% of this portfolio invested in two equity positions: Hope Industries and Hummer Securities.

Stock	Shares	Stock price (Sh.)
Hope Industries	375,000	26.20
Hummer Securities	300,000	34.00

Silvia investigates whether a privately negotiated equity swap could be used to reduce the risk of the Hope Industries and Hummer Securities holding. A swap dealer offers Silvia the following two options:

- The dealer will receive the return on 250,000 shares of Hope Industries and 200,000 shares of Hummer Securities from client.
- The dealer will pay the client the return on an equivalent amount on the Russell 3,000 index.

The dealer demonstrates the quarterly cash flows of this transaction under the assumptions that Hope Industries is up 2%, Hummer Securities is up 4% and the Russell 3,000 index is up 5% for the quarter.

**Required:**

The payoff to the client in the equity swap. (4 marks)

**(Total: 20 marks)**

**QUESTION FIVE**

- (a) Kansanga Ltd., a Ugandan company exports products to Kenya. Kansanga Ltd. has just closed a sale worth Kenya shillings (KES) 200,000,000. The amount will be received in two months. Since it will be paid in KES, the Ugandan company bears the exchange rate risk. In order to hedge this risk, Kansanga Ltd. intends to use a forward contract that is priced at Uganda shillings (UGX).

$$1 \text{ KES} = 28,544 \text{ UGX}$$

**Required:**

- (i) Illustrate how the company would go about constructing the hedge. (3 marks)
- (ii) Explain what happens when the forward contract expires in two months. (1 mark)
- (b) Emase Omanyala, a Certified Investment and Financial Analyst (CIFA), is a risk manager at Baraka Asset Managers (BAM). Emase works with individual clients to manage their investment portfolios. One client, John Mwajuma, is worried about how short-term market fluctuations over the next three months might impact his equity position in Mnazi Moja Corporation. While John is concerned about short-term downside price movements, he wants to remain with investments in Mnazi Moja Corporation shares as he remains positive about its long-term performance. John has asked Emase to recommend an option strategy that would keep him with investments in Mnazi Moja Corporation shares while protecting against a short-term price decline.

Emase gathers the following information to explore various strategies to address John's concerns:

**Table 1:**

Mnazi Moja Corporation European Options				
Exercise price (Sh.)	Market call price (Sh.)	Call delta	Market put price (Sh.)	Put delta
55.00	12.83	4.7	0.24	-16.7
65.00	3.65	12.0	1.34	-16.9
67.50	1.99	16.5	2.26	-15.3
70.00	0.91	22.2	3.70	-12.9
80.00	0.03	35.8	12.95	-5.0

**Additional information:**

1. Mnazi Moja Corporation's current share price is Sh.67.79.
2. Each option has 106 days remaining until expiration.

Another client, Samuel Momanyi, is a trader who does not currently own shares of Mnazi Moja Corporation. Samuel has told Emase that he believes that Mnazi Moja Corporation shares will experience a large move in price after the upcoming quarterly earnings release in two weeks. However, Samuel tells Emase that he is unsure of the direction that the stock will move. Samuel asks Emase to recommend an option strategy that would allow him to profit should the share price move in either direction.

A third client, Anthony Murungi does not currently own Mnazi Moja shares and has asked Emase to explain the profit potential of three strategies using options in Mnazi Moja Corporation: a bull call spread, a strangle and a butterfly spread. In addition, Anthony asks Emase to explain the gamma of a call option. In response, Emase prepares a memo to be shared with Anthony that provides analysis on three option strategies:

- Strategy 1: A strangle position at the Sh.67.50 strike option.  
Strategy 2: A bull call spread using the Sh.65 and Sh.70 strike options.  
Strategy 3: A butterfly spread using the Sh.65, Sh.67 and Sh.70 strike call options.

**Required:**

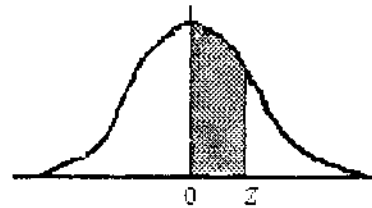
- (i) Citing appropriate reason(s), explain the option strategy that Emase should recommend to John Mwajuma. (2 marks)
- (ii) Citing appropriate reason(s), explain the option strategy that Emase should recommend to Samuel Momanyi. (2 marks)
- (iii) Based on the information given above on Mnazi Moja Corporation's European options, estimate the share price at expiration at which strategy 1 would be profitable. (3 marks)
- (iv) In relation to the data given in Table 1 above, estimate the maximum profit, on a per share basis, from investing in strategy 2. (3 marks)
- (v) Using the information given in Table 1 above, and assuming that the market price of Mnazi Moja Corporation's shares at expiration is Sh.66, estimate the profit or loss, on a per share basis, from investing in strategy 3. (3 marks)
- (vi) In the context of the data given in Table 1 above, determine the strike price of the call option with the largest gamma. (3 marks)

(Total: 20 marks)

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z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
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0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
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1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

NOT FOR SALE



# KASNEB

## CIFA PART III SECTION 6

### DERIVATIVES ANALYSIS

FRIDAY: 25 November 2016.

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) Derivatives trade in markets around the world, which include organised exchanges where highly standardised and regulated versions exist, and Over-the-Counter (OTC) markets, where customised and more highly regulated versions trade.

In relation to the above statement, discuss the following types of derivatives contracts:

- (i) Forward contract. (2 marks)
  - (ii) Futures contract. (2 marks)
  - (iii) Swap contract. (2 marks)
  - (iv) Option. (2 marks)
- (b) Consider a two-period binomial model in which a share currently trades at a price of Sh.97.50. The share price can increase by 30% or reduce by 25.50% in each period. The risk-free rate is 7.50%.

**Required:**

- (i) The price of a put option today that is expiring in two periods with an exercise price of Sh.90. (6 marks)
  - (ii) Based on the results in (b)(i) above, calculate the number of units of the underlying stock that would be required at each point in the binomial tree in order to construct a risk-free hedge. Use 15,000 puts. (6 marks)
- (Total: 20 marks)**

#### QUESTION TWO

- (a) Explain three factors that could affect the price of an option. (3 marks)
- (b) Citing three reasons, justify why futures options are increasingly becoming popular in the derivatives markets. (6 marks)
- (c) The following information relates to a European put futures option on crude oil:
- 1. The time to the option's expiration is 4 months.
  - 2. The current futures price is Sh.20.
  - 3. The futures exercise price is Sh.20.
  - 4. The risk-free interest rate is 9% per annum.
  - 5. The volatility on the futures price is 25% per annum.

**Required:**

The put price on a European put futures option. (3 marks)

- (d) A European receiver swaption expires in one year and is on a two-year swap that will make semi-annual payments. The swaption has an exercise rate of 7.2%. The notional principal is Sh.49 million. At the time of expiration, the term structure of interest rates is as follows:

$L_0(180) = 0.0412$   
 $L_0(360) = 0.0465$   
 $L_0(540) = 0.0533$   
 $L_0(720) = 0.0648$

**Required:**

Illustrate four possible ways in which this swaption could be exercised, evaluating the relevant cash flows in each case. (8 marks)

**(Total: 20 marks)**

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Out of 3

### QUESTION THREE

- (a) (i) Distinguish between "price limit" and a "position limit" as applied in derivatives markets. (2 marks)
- (ii) Explain the purpose of price limit and position limit in derivatives markets. (2 marks)
- (b) Argue three cases against hedging in the derivatives markets. (3 marks)
- (c) The board of directors of Palex Ltd. is concerned about the downside risk of a Sh.100 million equity portfolio in its pension plan. The board's consultant has proposed hedging the equity portfolio with either futures or options in a temporary period of one month.

**Required:**

Using the following factors, describe how the use of futures differ from the use of options when hedging a portfolio's equity exposure:

- (i) Initial cost. (2 marks)
- (ii) Effect of implied volatility in pricing. (2 marks)
- (iii) Sensitivity to movement in the value of the underlying. (2 marks)
- (iv) Risk exposure. (2 marks)
- (d) The following information relates to a currency forward contract involving two currencies, the Kenya Shilling (KES) and the United States Dollar (USD):

Forward price (KES/USD)	0.01
Risk-free rate (Kenya)	6%
Risk-free rate (United States)	8%
Current spot rate (KES/USD)	0.009
Time to expiration	165 days

**Required:**

The value of the currency forward contract. (2 marks)

- (e) A portfolio manager expects to purchase a portfolio of stocks in 90 days from the Nairobi Securities Exchange (NSE). The manager decides to take a long position on a 90-day forward contract on the NSE 20 share index. The index is currently at 4580. The continuously compounded dividend yield is 1.75% while the discrete risk-free rate is 4.25%.

**Required:**

The value of the forward contract 28 days into the life of the forward contract; if the NSE 20 share index is at 4,900. Assume a 365-day year.

(3 marks)

(Total: 20 marks)

### QUESTION FOUR

- (a) Johnson Mwakasi is a derivatives consultant handling three clients; A, B and C who have the following investment positions:
1. Client A has invested in stocks with a strong European exposure and he says that his portfolio has a positive delta.
  2. Client B has invested in stocks of financial firms and she says that her portfolio has a negative rho.
  3. Client C has recently retired and has managed to establish large option positions as a stock investor. He says that his portfolio has a positive theta

**Required:**

Explain the meaning of each claim made by each client. (6 marks)

- (b) In a Treasury bond futures contract, it is known that the cheapest bond to deliver will be a 12% coupon bond with a conversion factor of 1.6000. It is also known that the delivery will take place in 270 days. Coupons are payable semi-annually on the bond. The last coupon date was 60 days ago. The next coupon date is in 122 days and the coupon thereafter is in 305 days. The term structure is flat and the rate of interest with continuous compounding is 10% per annum. The current quoted bond price is Sh.115.

**Required:**

The quoted futures price.

(5 marks)

- (c) The following information relates to a European call option on the S&P 500 market index with two months to maturity:

1. The current value of the index is Sh.930.
2. The exercise price is Sh.900.
3. The risk-free interest rate is 8% per annum.
4. The volatility of the index is 20% per annum.
5. Dividend yields of 0.2% and 0.3% are expected in the first and second month.

**Required:**

The call price using Black-Scholes-Merton (BSM) model.

(4 marks)

- (d) The spot price of corn is Sh.3.50 and it costs Sh.0.017 to store a bushel of corn for 1 month while the relevant cost of financing is 1% per month. The corn futures contract matures in 6 months and the current futures price for this contract is Sh.3.95 per bushel. The storage cost is paid at the onset of the transaction. There are 5,000 bushels per contract.

**Required:**

The arbitrage profit from the transaction.

(5 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) Assess three types of margins that an investor participating in a futures exchange could access. (6 marks)

- (b) Boaz Miriti manages the family investment portfolio which initially consisted of Sh.46 million of equities and Sh.32 million of bonds. As a result of a change in family circumstances, the portfolio is rebalanced using the transaction shown below:

Type of futures contract	Action	Number of futures contract to buy or sell	Price per futures contract (Sh.)
Equity futures contract	Buy	42	160,000
Bond futures contract	Sell	35	190,000

Three months after the above transactions, the market value of the family portfolio's equities has increased by 300% and the market value of its bonds has decreased by 240%. The prices of the equity futures contract and bond futures contract are now Sh.165,000 and Sh.185,250 respectively.

**Required:**

The profit or loss of the family investment portfolio over the past three months.

(4 marks)

- (c) John Mukungi is a portfolio manager with Raimulo Financial Services. He manages a portfolio consisting 65% allocation to equities and 35% allocation to bonds. The portfolio has a market value of Sh.200 million. The beta of the equity position is 1.15, and the modified duration of the bond position is 6.75. The portfolio manager wishes to increase the equity allocation to 85% and reduce the bond allocation to 15% for a period of 6 months.

In addition to altering asset allocations, John Mukungi would also like to increase the beta on the equity position to 1.20 and increase the modified duration of the bonds to 8.25.

A stock index futures contract that expires in six months is priced at Sh.157,500 and has a beta of 0.95. A bond futures contract that expires in six months is priced at Sh.109,000 and has implied modified duration of 5.25. The stock futures contract has a multiplier of 1.

**Required:**

- (i) Demonstrate how John Mukungi could achieve his goals by using stock index and bond futures. (5 marks)
- (ii) The number of futures contracts. (4 marks)
- (iii) Indicate whether the portfolio manager should go long or short. (1 mark)

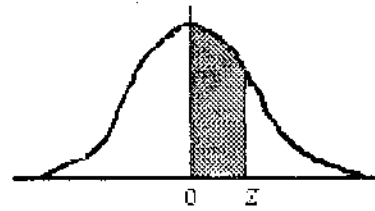
(Total: 20 marks)

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z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
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0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

NOT FOR SALE

# KASNEB

## CIFA PART III SECTION 6

### DERIVATIVES ANALYSIS

FRIDAY: 27 May 2016.

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) Discuss the following terms as used in the swaps market:

- (i) Index amortising swap. (2 marks)
- (ii) Arrears swap. (1 mark)
- (iii) Index differential swap. (2 marks)
- (iv) Overnight index swap. (1 mark)

(b) A two year swap with semiannual payments pays a floating rate and receives a fixed rate. The term structure at the beginning of the swap is as follows:

$$L_0(180) = 0.0583$$

$$L_0(360) = 0.0616$$

$$L_0(540) = 0.0680$$

$$L_0(720) = 0.0705$$

Where:  $L_i(m)$  is the m-day LIBOR on day i.

In order to mitigate credit risk of the parties engaged in the swap, the swap will be marked to market in 180 days. Suppose it is now 180 days later and the swap is being marked to market. The new term structure is as follows:

$$L_{180}(180) = 0.0429$$

$$L_{180}(360) = 0.0538$$

$$L_{180}(540) = 0.0618$$

#### Required:

- (i) The market value of the swap per Sh.1 notional principal. Indicate the amount paid by each party. (6 marks)
  - (ii) The new fixed rate on the swap at which the swap would proceed after marking to market. (2 marks)
- (c) Fredrick Aloo offers fixed income portfolio management services to institutional investors. He would like to execute a duration changing strategy for a Sh.100 million bond portfolio for a particular client. This portfolio has a modified duration of 7.2. Fredrick plans to change the modified duration of the portfolio to 5.0 by using a futures contract priced at Sh.120,000 which has an implied modified duration of 6.25 and a yield beta of 1.15.

#### Required:

- (i) Determine the number of futures contracts that Fredrick Aloo should sell. (2 marks)
- (ii) Suppose that the yield on the bond has decreased by 20 basis points at the horizon date, the bond portfolio has increased in value by 1.5% and the futures price has increased to Sh.121,200.

Determine the overall gain on the portfolio and the ex-post modified duration as a result of the futures transaction. (4 marks)

(Total: 20 marks)

## QUESTION TWO

- (a) Describe five ways that could be used to manage credit risk in derivatives markets. (5 marks)
- (b) European put and call options with an exercise price of Sh.45 will expire in 115 days. The underlying asset is priced at Sh.48 and makes no cash payments during the life of the options. The risk free rate is 4.5%. The put is selling for Sh.3.75 and the call is selling for Sh.8.

### Required:

- (i) Using suitable computations, identify the mispricing in the call. (2 marks)
- (ii) Execute an arbitrage transaction. (4 marks)
- (c) On 10 January 2016, SCM Ltd. determined that it would need to borrow Sh.5 million on 15 February 2016 at 90 day LIBOR plus 300 basis points. The loan would be an add on interest loan in which SCM Ltd. would receive Sh.5 million and pay it back plus interest on 16 May 2016.

To manage the risk associated with the interest rate on 15 February 2016, SCM Ltd. buys an interest rate call that expires on 15 February 2016 and pays off on 16 May 2016. The exercise rate is 5% and the option premium is Sh.10,000. The current 90 days LIBOR is 5.25%. Assume that this rate, plus 300 basis points is the rate at which SCM Ltd. would borrow at for any period of up to 90 days if the loan were taken out today.

Interest is computed on the exact number of days divided by 360.

### Required:

- Determine the effective annual rate on the loan when the 90 day LIBOR on 15 February 2016 is at 6%. (5 marks)
- (d) A futures contract has a current price of Sh.212. The initial margin requirement is Sh.10 and the maintenance margin requirement is Sh.8. An investor goes long 20 contracts and meets all margin calls and does not withdraw any excess margin.

The futures price in the days following are shown below:

Day	Futures price (Sh.)
0	212
1	211
2	214
3	209
4	210
5	204
6	202

### Required:

- The investor's total gain or loss by the end of day 6. (4 marks)
- (Total: 20 marks)

## QUESTION THREE

- (a) Differentiate between a "payer swaption" and a "receiver swaption". (2 marks)
- (b) Discuss the following terms as used in the options markets:
- (i) Naked position. (2 marks)
- (ii) Covered position. (2 marks)
- (iii) Stop loss strategy. (2 marks)
- (c) A Kenyan corporation with a Tanzanian subsidiary generates cash flows of Tsh.10 million in a year. The subsidiary is considering using a currency swap to lock in the rate at which it converts to Kenyan shillings. The current exchange rate is Ksh.0.825/Tsh. The fixed rate on a currency swap in Tanzania shillings is 5%.

### Required:

- Determine the overall periodic cash flow from the subsidiary operations and the swap. (4 marks)

- (d) An airline expects to purchase 2 million barrels of jet fuel in 1 month and decides to use heating oil futures for hedging.

The table below gives the data on the change in jet fuel prices per barrel and the corresponding change in the futures price for the contract on heating oil that would be used for hedging price changes during the month:

Month	Change in futures price per barrel ( $x_i$ )	Change in fuel price per barrel ( $y_i$ )
1	0.021	0.029
2	0.035	0.020
3	-0.046	-0.044
4	0.001	0.008
5	0.044	0.026
6	-0.029	-0.019
7	-0.026	-0.010
8	-0.029	-0.07
9	0.048	0.043
10	-0.06	0.011
11	-0.036	-0.036
12	-0.011	-0.018
13	0.019	0.009
14	-0.027	0.032
15	0.029	0.032

The summarised calculations are as follows:

$$\begin{aligned}\sum x_i &= -0.013 \\ \sum y_i &= 0.003 \\ \sum x_i^2 &= 0.0138 \\ \sum y_i^2 &= 0.097\end{aligned}$$

Each heating oil contract traded has 42,000 barrels of heating oil.

**Required:**

The optimal number of contracts required for hedging.

(8 marks)

(Total: 20 marks)

#### QUESTION FOUR

- (a) Assess the effect of the following factors on option prices:

(i) Interest rates.

(1 mark)

(ii) Volatility.

(1 mark)

- (b) Jonathan Atwori is doing some scenario analysis on forward contracts. The process involves pricing the forward contracts and then estimating their values based on likely scenarios provided by the firm's forecasting and strategy department. The forward contracts with which Jonathan is most concerned are those on fixed income securities, interest rates and currencies.

#### Fixed income securities forward contract

The first contract he needs to price is a 270 day forward on a Sh.1 million Treasury bond with 10 years to maturity. The bond has a 5% coupon rate, has just made a coupon payment, and will make its next two coupon payments in 182 days and 365 days respectively. It is currently selling for Sh.98.25. The effective annual risk free rate is 4%.

#### Interest rates forward contract

Jonathan analyses forward rate agreements (FRA) using the LIBOR spot rate curve as follows:

30 day: 3.12%	60 day: 3.32%	90 day: 3.52%
120 day: 3.72%	150 day: 3.92%	180 day: 4.12%



After 30 days, Jonathan wants to value a Sh.10 million short position in the FRA. The 90 day forward rate in 30 days is now 4.14% and the original price of the FRA which was 4.30% for 120 day LIBOR has changed to 3.92%.

#### Currency forward contract

Jonathan also wants to price and value a currency forward on euros. The euro spot rate is 1.1854 USD. The dollar risk free rate is 3% and the euro risk free rate is 4%.

#### Required:

- (i) Determine the no arbitrage price for the forward contract on the Treasury bond. (2 marks)
  - (ii) Assume that the Treasury bond price decreases to Sh.98.11 (including accrued interest) over the next 60 days. Calculate the value of the short position in the 270 day forward contract on a Sh.10 million bond. (2 marks)
  - (iii) Calculate the price of a 2 x 5 forward rate agreement (FRA). (2 marks)
  - (iv) Determine the current value of the Sh.10 million FRA to the short position under the second scenario mentioned above. (2 marks)
  - (v) Calculate the no arbitrage price for a 1- year forward contract on the euros. (2 marks)
- (c) A stock index is at 755.42. A futures contract on the index expires in 57 days. The risk free rate is 6.25%. At expiration, the value of the dividends on the index is 3.94.

Assume one year has 365 days.

#### Required:

- (i) The appropriate futures price, using both the future value of the dividends and the present value of the dividends. (3 marks)
- (ii) The appropriate futures price in terms of the two specifications of the dividend yield. (3 marks)
- (iii) The futures price under the assumption of continuous compounding of interest and dividends based on the solution obtained in (c)(i) above. (2 marks)

(Total: 20 marks)

#### QUESTION FIVE

- (a) Evaluate two applications of index futures. (2 marks)
- (b) Your country is in the process of establishing a derivatives market. After an advertisement in the local dailies for an expert consultant to offer advisory services on derivatives markets, you are recruited and the first task you are given is to advise the relevant committee on the challenges they expect to face while trading derivatives instruments.

#### Required:

Highlight three challenges that the prospective derivatives market is likely to face. (3 marks)

- (c) TSST Ltd. plans to borrow Sh.10 million in 30 days at 90 day LIBOR plus 100 basis points. To lock in a borrowing rate of 7%, TSST Ltd. purchases a forward rate agreement (FRA) at a rate of 6%. Thirty days later, LIBOR is 7.5%.

#### Required:

Demonstrate that TSST Ltd.'s effective borrowing rate is 7% if LIBOR in 30 days is 7.5%. (4 marks)

- (d) Fusions derivatives services (FDS) is an options trading company that trades in a variety of derivatives instruments. FDS has just sold 500 call options on a stock currently priced at Sh.125.75. The trading date is 18 May 2016. The call has an exercise price of Sh.125, 60 days to expiration, a price of Sh.10.89, and a delta of 0.5649. FDS contemplates delta-hedging this transaction by purchasing an appropriate number of shares. Any additional transactions required to adjust the delta hedge will be executed by borrowing or lending at the risk free rate of 4%.

FDS has began delta-hedging the option. Two days later, on 20 May 2016, the following information is provided:

Stock price	Sh.122.75
Option price	Sh.9.09
Delta	Sh.0.5176
Number of options	500
Number of shares	328
Bond balance	-Sh.6,072
Market value	Sh.29,645

**Required:**

- (i) Assuming that at the end of 19 May 2016, the delta was 0.6564, show how 328 shares could be used to delta-hedge 500 call option. (2 marks)
- (ii) Show the allocation of the Sh.29,645 market value of FDS's total position among stock, options and bonds on 20 May 2016. (2 marks)
- (iii) Demonstrate the transactions that must be done to adjust the portfolio to be delta-hedged the following day (21 May 2016). (4 marks)
- (iv) On 21 May 2016, the stock is worth Sh.120.50 and the call is worth Sh.7.88. Compute the market value of the delta-hedged portfolio and compare it with a benchmark, based on the market value on 20 May 2016. (3 marks)

**(Total: 20 marks)**

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# KASNEB

## CIFA PART III SECTION 6

### DERIVATIVES ANALYSIS

FRIDAY: 27 November 2015.

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) (i) Describe how an arbitrage opportunity might exist in relation to derivatives markets. (2 marks)
- (ii) Explain the law of one price as applied in derivatives markets. (2 marks)
- (b) The table below illustrates three European call options with the same underlying asset:

	Time to expiration (months)	Exercise price (Sh.)
Option A	6	2,000
Option B	9	2,000
Option C	9	2,500

#### Required:

Giving appropriate reasons, determine the option with the highest value. (3 marks)

- (c) Explain the following terms with respect to derivative instruments:
- (i) Fiduciary call. (1 mark)
- (ii) Protective put. (1 mark)
- (d) Samuel Mukungi simultaneously purchases an underlying asset priced at Sh.154 and writes a call option on it with an exercise price of Sh.160 and selling at Sh.12.

#### Required:

- (i) State the term commonly used to describe the position taken by Samuel Mukungi. (1 mark)
- (ii) Determine the value of the position at expiration and the profit (loss) for Samuel Mukungi if the price of the underlying asset at expiration is Sh.140, Sh.150, Sh.160 and Sh.170. (5 marks)
- (iii) The maximum profit and the maximum loss. (2 marks)
- (iv) The expiration price of the underlying which Samuel Mukungi would realise the maximum profit and incur the maximum loss. (2 marks)
- (v) The break-even price at expiration. (1 mark)

(Total: 20 marks)

#### QUESTION TWO

- (a) Explain two arrangements that could be used to settle the obligations of the parties to a forward contract when it expires. (4 marks)
- (b) (i) Explain the term "credit derivative". (2 marks)
- (ii) Examine two types of credit derivatives. (4 marks)
- (c) Baimunge Mugenda is a Kenyan-based importer of machinery from Britain. He expects the value of the Sterling Pound to appreciate against the Kenyan Shilling (Ksh.) over the next 30 days. He will be making payment on a shipment of imported machinery in 30 days and intends to hedge the currency exposure. The Kenyan risk-free rate is 16.5 per cent and the United Kingdom risk-free rate is 5.0 per cent. These rates are expected to remain constant in the next 30 days.

The current spot rate is Ksh.150 per Sterling Pound.

**Required:**

- (i) Justify whether Baimunge Mugenda should use a long or a short forward contract to hedge against the currency risk. (2 marks)
- (ii) The no-arbitrage price at which Baimunge Mugenda should enter into for a forward contract that expires in 30 days. (4 marks)
- Assume a 365-day year.
- (iii) Compute the value of Baimunge Mugenda's forward position if he moves forward 10 days and the spot rate changes to Ksh.153 per Sterling Pound while the interest rates remain constant. (4 marks)

**(Total: 20 marks)**

**QUESTION THREE**

- (a) Kimanzi Mutua is the chief trader at the Federal Futures Exchange (FFE), the only futures exchange in his country. One of his duties is to determine the prices of different types of futures contracts traded at FFE.

**Required:**

Assess how Kimanzi Mutua could determine the price of the following types of futures contracts traded at FFE:

- (i) Treasury bond futures contracts. (2 marks)
- (ii) Stock index futures contracts. (2 marks)
- (iii) Currency futures contracts. (2 marks)
- (b) A futures contract on a treasury bill expires in 91 days. The treasury bill matures in 182 days. The interest rates on treasury bills are as follows:

91-day treasury bill: 22.13%

182-day treasury bill: 21.84%

Assume a year has 360 days.

**Required:**

- (i) The appropriate futures price using the prices of the 91-day treasury bill and 182-day treasury bill. (4 marks)
- (ii) The futures price in terms of the underlying asset spot price compounded at the appropriate risk-free rate. (3 marks)
- (iii) Convert the futures price computed in (b) (i) above to the implied discount rate on the futures. (3 marks)
- (iv) Assume that the futures contract is trading in the market at an implied discount rate of 20 basis points lower than is appropriate, given the pricing model and the rule of no arbitrage.

Illustrate how an arbitrage transaction could be executed. Show the outcome.

(4 marks)

**(Total: 20 marks)**

**QUESTION FOUR**

- (a) Discuss three uses of swaptions. (6 marks)
- (b) Assume that you have just been employed by Fiduciary Investment Bank after completing the CIFA qualification. Your main responsibility is to trade and offer advisory services on derivatives. You are provided with the following information:

Current market price of the share	Sh.92
Exercise price of the call option	Sh.90
Call premium	Sh.10
Delta	0.584
Number of calls sold	2,000
Delta at the end of the previous day	0.68
Continuously compounded risk-free rate	9.0%

**Required:**

- (i) The number of shares needed to delta-hedge the call position at the end of the previous day. (2 marks)



- (ii) The market value of the portfolio today given that the loan balance at the end of the previous day was Sh.6,000. (3 marks)
- (iii) Illustrate the transactions that would need to be made to adjust the portfolio to be delta-hedged for the following day. (5 marks)
- (c) Omingo Ogot is an equity swap trader. He considers an equity swap in which he would receive the return on Index A in return for paying the return on Index B. At the inception of the equity swap, Index A is at 956.38 and Index B is at 19,734.66. The notional principal of the swap is Sh.30 million.

**Required:**

The market value of the swap, three months later, when Index A is at 1,048.58 and Index B is at 20,032. (4 marks)  
(Total: 20 marks)

**QUESTION FIVE**

- (a) In derivatives markets, numerous opportunities and strategies exist for managing risk using futures and forwards. Some types of hedges are almost always executed using futures while others are almost always executed using forwards. The choice or preference for one of the above derivative instruments over the other to hedge risk is prompted by their distinct characteristics.

**Required:**

Evaluate five primary differences between forward contracts and futures contracts that would make a derivatives analyst to prefer one of these derivatives instruments over the other when managing risk. (5 marks)

- (b) The following information relates to a put and a call option on a stock:

Call price, $C_0$	=	Sh.9.0
Put price, $P_0$	=	Sh.13.60
Exercise price, $X$	=	Sh.140
Time to option expiration, $T$	=	142 days
Current stock price, $S_0$	=	Sh.134.64
Risk-free rate, $r_f$	=	6%

One year is assumed to have 365 days.

**Required:**

Compute the prices of the following using put-call parity:

- (i) Synthetic call option. (2 marks)
- (ii) Synthetic put option. (2 marks)
- (iii) Synthetic bond. (2 marks)
- (iv) Synthetic underlying stock. (2 marks)
- (c) The price of a futures contract is Sh.278.38 and a European call option on this futures contract has an exercise price of Sh.250.00 with a time to expiration of 220 days. The continuously compounded risk-free rate is 21.25 per cent and the volatility is 0.19.

A year is assumed to have 365 days.

**Required:**

The price of the call using the Black Model. (7 marks)

Hint: The formula for the Black Model is given by:

$$C = e^{-r_f T} [f_0(T) N(d_1) - X N(d_2)]$$

$$P = e^{-r_f T} [X(1 - N(d_2)) - f_0(T) [1 - N(d_1)]]$$

Where

$$d_1 = \frac{\ln(f_0(T)/X) + (\sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$f_0(T)$  = The futures price

$C$  = Price of the European call on a futures contract

$X$  = Exercise price

$P$  = Price of European put

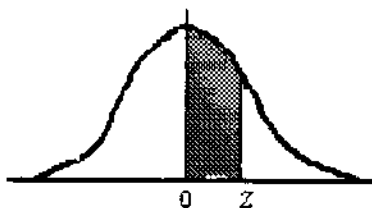
$r^c$  = Continuously compounded risk-free rate

$\sigma$  = Annualised standard deviation of the continuously compounded return on the stock

(Total: 20 marks)

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NORMAL CURVE  
from 0 to z



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z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

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# KASNEB

## CIFA PART III SECTION 6

### DERIVATIVES ANALYSIS

#### PILOT PAPER

September 2015.

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) Consider a bond portfolio value of Sh.1,036,300 (duration 1.793), a futures value of Sh.102,510 (duration 1.62) and a yield Beta of 1.2.

**Required:**

- (i) Calculate the required number of contracts to reduce the portfolio duration to zero. (2 marks)
- (ii) Calculate the required number of contracts to achieve a target duration of 1.0. (2 marks)
- (b) Briefly discuss the meaning and importance of the terms "delta", "theta" and "vega" as applied in option pricing. (6 marks)
- (c) Assume that your company has invested in 100,000 shares of Unglow Ltd., a manufacturer of light bulbs. You are concerned about recent volatility in Unglow Ltd.'s share price due to unpredictable weather. You wish to protect your company's investment from a possible fall in Unglow Ltd.'s share price until change of weather in three months time, but do not wish to sell the shares at present.

No dividends are due to be paid by Unglow Ltd. during the next three months.

**Market data:**

Unglow Ltd.'s current share price:	Sh.20
Call option exercise price:	Sh.22
Time to expiry:	3 months
Interest rates (annual):	6%
Volatility of Unglow Ltd.'s shares:	50% (standard deviation per year)

Assume that option contracts are for the purchase or sale of units of 1,000 shares.

**Required:**

- (i) Devise a delta hedge that is expected to protect the investment against changes in share price until the change of weather. Delta may be estimated using  $N(d_1)$ . (8 marks)
- (ii) Comment on whether such a hedge is likely to be totally successful. (2 marks)
- (Total: 20 marks)

#### QUESTION TWO

- (a) A stock price currently sells for Sh.36. In the next six months, the stock price will either increase to Sh.42 or decrease to Sh.31. The risk free rate is 4% per year.

**Required:**

Calculate the current price of a call option on the above stock if it's term to expiration is six months and it's strike price is Sh.35. (6 marks)

- (b) Explain the following terms:

- (i) Vocational arbitrage. (2 marks)
- (ii) Triangular arbitrage. (2 marks)



- (c) The following information is provided about the current spot rate between the United States (US) dollar (\$) and British pound (£), inflation rates in Britain and United States and real interest rates:

Current spot rate	=	\$1.4500/£
US inflation rate	=	1.5% per year
British inflation rate	=	2.0% per year
Real rate of interest	=	2.5%

**Required:**

Using the parity condition:

- (i) Compute the expected spot rate in one year's time. (2 marks)
- (ii) Assuming that you could borrow \$1,000,000 or £689,700 at the risk free interest rate, demonstrate how you could make an arbitrage profit if you were offered the chance to sell or buy British pound (£) forward for delivery one year from now at the current spot rate of \$1.4500/£. (8 marks)

(Total: 20 marks)

**QUESTION THREE**

- (a) State and briefly explain the relationship between a call option price and the following determinants:

- (i) The underlying stock's price. (2 marks)
- (ii) The exercise price. (2 marks)
- (iii) The time to maturity. (2 marks)
- (iv) The risk-free rate. (2 marks)

- (b) Zawadi Ltd. is considering introducing an executive share option scheme. The scheme would be offered to all middle level managers of the company. It would replace the existing scheme of performance bonuses linked to the post tax earnings per share of the company. Such bonuses in the last year ranged between Sh.500,000 and Sh.700,000. If the option scheme is introduced new options are expected to be offered to the managers each year.

It is proposed that for the first year, all middle level managers be offered options to purchase 500,000 shares at a price of Sh.500 per share, after the options have been held for one year. If the options are not exercised at that time, they will lapse. Assume that the tax authorities allow the exercise of such options after they have been held for one year.

The company's shares have a current market price of Sh.6.10 per share. The dividend paid was Sh.0.25 per share, a level that has remained constant for the last three years.

Assume that dividends are only paid annually.

The company's share has experienced a standard deviation of 38% during the last year. The short term risk free interest rate is 6% per annum.

**Required:**

Evaluate whether or not the proposed share option scheme is likely to be attractive to middle level managers of Zawadi Ltd. (8 marks)

- (c) When informed of the scheme in (b) above, one middle level manager of Zawadi Ltd. stated that he would rather receive put options than call option, as they would be more valuable to him:

- (i) Explain whether or not Zawadi Ltd. should agree to offer him put options. (2 marks)
- (ii) Is the manager correct in his statement that put options would be more valuable to him? Explain. (2 marks)

(Total: 20 marks)

NB

$$C = S N(d_1) - E(e^{-rt}) N(d_2)$$

$$\text{Where: } d_1 = \frac{\ln\left(\frac{S}{E}\right) + (rt + 0.5\sigma^2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

#### QUESTION FOUR

- (a) The Dennevax Company Ltd. is an import-export company based in Kenya.

On 1 May 2015, the company exported coffee to South Africa on two months credit amounting to South African Rands (SAR) 14,000,000.

##### Additional information:

1. The rates in the forex and money markets were as follows:

	Ksh/1 SAR
1 May 2015	8.45
1 July 2015	8.40

	Interest rates
Kenya	21% per annum
South Africa	9% per annum

2. In the forex market, the SAR was quoted forward at an annual premium of 27%.  
3. The customer settled the amount due on 1 July 2015.

##### Required:

- (i) Expected two-month forward exchange rate as at 1 July 2015. (2 marks)
- (ii) Advise the Dennevax Company Ltd. on the better hedging strategy between forward contract and money market hedges. (6 marks)
- (b) (i) Explain the advantages of using interest rate swap techniques. (4 marks)
- (ii) Explain the risk involved in using interest rate swap techniques. (2 marks)
- (c) In relation to options markets, distinguish between the following terms:
- (i) Bull spread and bear spread. (2 marks)
- (ii) Box spread and butterfly spread. (2 marks)
- (iii) Straddle and strangles. (2 marks)
- (Total: 20 marks)

#### QUESTION FIVE

- (a) Consider a stock price at Sh.60 which pays dividend of Sh.5 per share in one month. The risk free rate is 10%. A forward contract expiring in a month was priced at Sh.59.37. One month later the spot price is Sh.62.

##### Required:

The forward price and the value of the contract at this stage. (6 marks)

- (b) A medium sized manufacturing company in South Africa is tendering for an order in Kuwait. The tender conditions state that payment will be made in Kuwait dinars 18 months from now. The company is unsure as to what price to tender.

The company's marginal cost of production at the time of tendering is estimated to be SA rand 1 million and a 25% mark up is normal for the company.

**Exchange rates**

Dinars/ 1 SAR

Spot 5.467 – 5.503

No forward rate exists for 18 months period

	South Africa	Kuwait
Annual inflation rates	9%	3%
Annual interest rates available to the manufacturing company:		
Borrowing	14%	9%
Lending	9%	3.5%

**Required:**

(a) Explain how the manufacturing company might protect itself against foreign exchange rate changes. (8 marks)

(b) Recommend the tender price that should be used. (6 marks)

(Total: 20 marks)

.....

FRIDAY: 29 May 2015.

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) Explain the following types of margins as used in the futures trading mechanism:
- (i) Initial margin. (1 mark)
  - (ii) Maintenance margin. (1 mark)
  - (iii) Variance margin. (1 mark)
  - (iv) Margin call. (1 mark)
- (b) Discuss four salient features of currency futures contracts. (8 marks)
- (c) As a derivatives analyst at Savannah Investment Bank, you have been provided with the following information regarding trading of a stock index futures contract at FSE Securities Exchange:
1. Value of FSE index = 4,000.
  2. Value of portfolio = Sh.1,000,000.
  3. Risk free interest rate = 8%.
  4. Dividend yield on index = 6% per annum.
  5. Beta of the portfolio ( $\beta$ ) = 1.5.
  6. Assume that a futures contract on the FSE index with five months to maturity is used to hedge the value of portfolio over the next three months.
  7. One futures contract is for delivery of Sh.50 times the index.

**Required:**

- (i) The futures price of the stock index. (3 marks)
  - (ii) The hedge ratio that should be shorted to hedge the portfolio. (2 marks)
  - (iii) The gain or loss from the short futures position resulting from the index changing to 3,500 in three months time. (3 marks)
- (Total: 20 marks)

**QUESTION TWO**

- (a) Argue four cases against the establishment of a derivatives market in your country. (8 marks)
- (b) The information below relates to a put and a call option on a share:
- Call price = Sh.4.50.  
Put price = Sh.6.80.  
Exercise price = Sh.70.  
Days to maturity = 139.  
Current share price = Sh.67.32.  
Risk free rate = 5%.

**Required:**

Using the put-call parity relationship, compute the price of each of the following:

- (i) Synthetic call option. (2 marks)
- (ii) Synthetic put option. (2 marks)
- (iii) Synthetic bond. (2 marks)
- (iv) Synthetic underlying share. (2 marks)

- (c) A United States (U.S.) based firm imports goods from Canada. The firm expects to receive the imported goods in 72 days. Since the payments will be in Canadian dollars (CAD), the U.S. firm intends to hedge against decline in the value of the CAD against the U.S. dollar (USD) over the next 72 days. The U.S. risk free rate is 5.1%, while the Canadian risk free rate is 6.3%. No change is expected in these rates over the next 60 days. The current spot rate is 0.820 USD per CAD.

Assume that one year has 360 days.

**Required:**

- The no-arbitrage forward price at which the United States firm should take a short position in the Canadian dollar contract. (4 marks)
- (Total: 20 marks)

**QUESTION THREE**

- (a) Evaluate four benefits that might accrue to a participant in a credit derivatives market. (8 marks)
- (b) The share of the Bank of Kenya Ltd. is currently trading at Sh.70 per share and has a 1-year call and put options written on it with an exercise price of Sh.70. The Bank pays no dividends. The annual standard deviation estimate is 11%. The value of the call is Sh.5.02 and the risk free rate is 6%.

**Required:**

The value of the put on Bank of Kenya Ltd.'s share.

(Hint: Use the concept of put/call parity).

(4 marks)

- (c) A 10% semi-annual treasury bond with exactly 6 years to maturity is currently priced at Sh.1,250. The current risk-free rate is 6%. The par value of the bond is Sh.1,000.

**Required:**

The no arbitrage price of the 1.3 year futures.

(4 marks)

- (d) Consider a long position of 5 July wheat contracts, each of which covers 5,000 bushels. Assume that the contract price is Sh.2.00 and that each contract requires an initial margin deposit of Sh.150 and a maintenance margin of Sh.100. The total initial margin required for the 5-contract trade is Sh.750. The maintenance margin for the account is Sh.500.

**Required:**

Compute the margin balance for this position after a 2-cent decrease in price on day 1, a 1-cent increase in price on day 2, and a 1-cent decrease in price on day 3.

(4 marks)

(Total: 20 marks)

**QUESTION FOUR**

- (a) Discuss the following terms in relation to risk management application of option strategies:

- (i) Interest rate put. (2 marks)
- (ii) Covered call. (2 marks)
- (iii) Protective call. (2 marks)

- (b) James Kirangi is an options trader at MSE Securities Exchange. During the last 30 minutes of trading, Kirangi observes that KBLD Limited's share price has increased from Sh.101.40 to Sh.102.50, and the market value of a certain call option, whose underlying asset is KBLD Limited's share has risen from Sh.3.20 to Sh.4.60 in price.

**Required:**

- (i) The delta of the call. (3 marks)
- (ii) The approximate change in the price of the option if KBLD Limited's share price has risen by Sh.3.50. Use the delta obtained in (b) (i) above. (2 marks)
- (iii) The number of shares to delta hedge a portfolio whose dealer is short 100 contracts of 100 calls each (that is 10,000 calls). (3 marks)

- (c) Forty days from now, KBC Bank plans to lend Sh.5 million for 180 days. The 91-day treasury bill, which is the reference lending rate, is currently quoted at 5%. KBC Bank's lending rate is 91-day treasury bill rate + 300 basis points. KBC Bank buys a put that matures in 40 days with a notional principal of Sh.5 million, 180 days in the underlying, and a strike rate of 4.5%. The put premium is Sh.500. The 91-day treasury bill rate is expected to be 4% at expiration.

**Required:**

The effective annual rate of the loan.

(6 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) Highlight four assumptions that a financial analyst should take into consideration when determining the price of a forward contract. (4 marks)

- (b) Jane Murathi holds PMG Ltd. shares which are selling at Sh.45 per share. She plans to sell the shares 150 days from now, though she is worried that the price of the shares may go down. She decides to take a short position in a 150-day forward contract on PMG Ltd. shares. The company will pay Sh.0.70 per share dividend in 45 days. After 175 days, the company will pay another dividend of Sh.0.70 per share. The risk free rate is 5%, and it will not change in the foreseeable future.

The number of days in a year is assumed to be 365.



**Required:**

The value of the traders position in 60 days assuming that in 60 days, the price of the share will be Sh.37.00. (4 marks)

- (c) Omolo Ong'ali is considering a receiver and a payer swaption on a Sh.2,000,000 one-year swap on quarterly London Interbank Offered Rate (LIBOR) with a fixed 7.8% (0.0195% quarterly). The annual swap market rate at expiration of the swaption is 8.8%. The LIBOR annual rates and their respective discount rates are given below:

	Annual rate (%)	Discount rate
90-day LIBOR	8.0	0.9809
180-day LIBOR	8.5	0.9600
270-day LIBOR	9.0	0.9374
360-day LIBOR	9.5	0.9132

**Required:**

The difference between the payoffs at expiration to a payer swaption and a receiver swaption. (4 marks)

- (d) You are the treasurer of a company with a 4-year, Sh.20 million forward rate note (FRN) outstanding at London Interbank Offered Rate (LIBOR). You are concerned about rising interest rates in the short-term and would like to refinance at a fixed rate for the next two years. A swap dealer arranges a 2-year plain vanilla interest rate swap with annual payments in which you pay a fixed rate of 8.1% and receive LIBOR. The counterparty receives 7.9% and pays LIBOR.

Assume that the counterparty has a Sh.20 million fixed-rate debt outstanding at 8%. One year LIBOR is currently quoted at 7%.

**Required:**

Compute each party's net borrowing cost and first year cash flows.

(8 marks)

(Total: 20 marks)



FRIDAY: 5 December 2014.

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) Evaluate four common characteristics of derivatives. (8 marks)
- (b) NBC Bank borrowed Sh.100 million, 1-year floating rate loan on 25 April 2013. Interest payment was to be made quarterly at London interbank offer rate (LIBOR) plus 300 basis points based on actual days on the period over 360 days in a year. The payments were due on 25 July 2013, 25 October 2013, 25 January 2014 and 25 April 2014.

NBC Bank purchased a nine-month quarterly pay interest rate cap for Sh.150,000, with a strike rate of 9.5%. The first caplet expired on 25 July 2013. The LIBOR rates on 25 April 2013, 25 July 2013, 25 October 2013 and 25 January 2014 were 9.0%, 9.4%, 9.6% and 9.4% respectively.

The day counts are calculated as follows:

25 April 2013 to 25 July 2013	91 days
25 July 2013 to 25 October 2013	92 days
25 October 2013 to 25 January 2014	92 days
25 January 2014 to 25 April 2014	90 days

Required:

- (i) The loan interest due on 25 July 2013, 25 October 2013, 25 January 2014, and 25 April 2014. (4 marks)
- (ii) The cap payoffs on 25 July 2013, 25 October 2013, 25 January 2014 and 25 April 2014. (8 marks)

(Total: 20 marks)

**QUESTION TWO**

- (a) Explain three factors that affect currency put option premiums. (6 marks)
- (b) Highlight four assumptions underlying the Black-Scholes-Merton Model (BSM) of option valuation. (4 marks)
- (c) On Tuesday, 25 November 2014, between 10.00 a.m. and 10.01 a.m., the call options on Supermatt Ltd.'s ordinary shares rose from Sh.1.30 to Sh.1.70. The price of the underlying share also rose from Sh.72.30 to Sh.73.05 during the same time interval.

Required:

The delta of the call option. (3 marks)

- (d) Hydrossoft Ltd. share is currently trading at Sh.60 in the securities exchange. The share has a one-year call option written on it with an exercise price of Sh.60.

Additional information:

- The annual standard deviation estimate is 10%.
- The continuous dividend yield is 1.4%.
- The continuously compounded risk-free rate is 5%.
- The value of the call is Sh.4.09.

Required:

The value of the put on Hydrossoft Ltd.'s share using the put-call-parity with continuously compounded interest rates. (3 marks)

- (e) A put option with an exercise price of Sh.200 is trading for Sh.4.50. The current price of the underlying share is Sh.200.

Required:

Explain the effect on the option's delta and gamma if the share price increases to Sh.250. (4 marks)

(Total: 20 marks)

**QUESTION THREE**

- (a) Distinguish between a "long" and a "short" in relation to forward contracts and markets. (4 marks)
- (b) Evaluate three disadvantages of forward contracts. (6 marks)
- (c) (i) John Mukungi has just entered into a 270-day forward contract on a zero-coupon bond with a par value of Sh.1,000 that is currently quoted at Sh.700. The risk-free annual interest rate is given as 7.2%.

Assume a year has 360 days.

Required:

The price of the forward contract under the no-arbitrage principle.

(3 marks)

- (ii) A 200-day forward on an ordinary share is priced at Sh.60 and is expected to pay a dividend of Sh.0.80 in 20 days and Sh.1.20 in 120 days. The annual risk free rate is 6%, and the yield curve is flat.

Assume a 365-day year.

Required:

The no-arbitrage price of the equity forward contract.

(4 marks)

- (iii) The risk-free rates in Kenya and Uganda are 8.8% and 9.8% respectively. The current spot exchange rate is Kenya shillings (Ksh.) 0.0344 per Uganda shilling (Ush.). Assume one year has 365 days and that Kenya is the domestic country.

Required:

The forward exchange rate for a 90-day currency forward contract.

(3 marks)

(Total: 20 marks)

**QUESTION FOUR**

- (a) Explain how the following types of risks expose traders in financial futures contracts and markets:

- Liquidity risk. (2 marks)
- Market risk. (2 marks)
- Basis risk. (2 marks)
- Operational risk. (2 marks)
- Prepayment risk. (2 marks)

- (b) A 10-year treasury bond with a face value of Sh.1,000 pays 12% semi-annual coupon. The bond has a conversion factor of 1.027. The risk free-rate is 11% and the annual yield on the bond is 12%. The bond has just made a coupon payment.

Required:

The price of a 15-month futures contract on this bond.

(6 marks)

- (c) The current value of the Asdaq stock index is Sh.1,850. The continuous dividend yield is 1.25% and the continuously compounded risk-free rate is 4.7%.

Assume a year has 365 days.

Required:

The no-arbitrage price of a 91-day futures contract on the Asdaq equity index.

(4 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) Highlight three benefits of derivatives that have made them indispensable to the global financial systems and economies in the recent past. (3 marks)

- (b) Differentiate between a "payer swaption" and a "receiver swaption". (4 marks)

- (c) KBA bank exercises a payer swaption at maturity. The swaption's underlying is a 1-year, Sh.20 million quarterly-pay treasury bill-based swap with a fixed rate of 6%. The market rate on the current interest rate swap is 7.093%. The annual rates and discount factors for the 90-day, 180-day, 270-day and 360-day treasury bill rates are as shown below:

Treasury bill	Rate (%)	PVIF <sub>t,t</sub>
90-day	5.5	0.98644
180-day	6.0	0.97087
270-day	6.5	0.95352
360-day	7.0	0.93458

Assume a year has 360 days.

Required:

Value of the swaption at expiration.

(6 marks)

- (d) A futures contract is priced at Sh.145. European options on the futures contract have an exercise price of Sh.150 and expire in 65 days. The continuously compounded risk-free rate is 3.75% and the volatility is 0.33.

Assume a year has 365 days.



**Required:**

The price of a call option on the futures contract using the Black Model.

(7 marks)  
(Total: 20 marks)

Hint: The Black Model's formula is given as:

$$C_0 = e^{-R^f T} [F_T \cdot N(d_1) - X \cdot N(d_2)]$$

$$d_1 = \frac{\ln\left(\frac{F_T}{X}\right) + \left(\frac{\sigma^2}{2}\right) T}{\sigma \sqrt{T}}$$

$$d_2 = d_1 - \sigma \sqrt{T}$$

Where:  $\sigma$  = Standard deviation of returns.  
 $F_T$  = Futures price  
 $R^f$  = Continuously compounded risk-free rate.  
 $X$  = Exercise price.  
 $C_0$  = Price of a call option on futures.

**KASNEB**

CSIA PART III SECTION 6

### VALUATION AND ANALYSIS OF DERIVATIVES

FRIDAY: 7 December 2012.

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) Assume that on 12 November 2012, the stock of bank X was selling at Sh.44.20 per share. January 2013 call options were standing at an exercise price of Sh.30.

##### Additional information:

- The bank was expected to go ex-dividend with a dividend pay-out of Sh.5.60 per share on 13 November 2012.
- The risk free rate of interest is 14%.
- The maturity date of the options is 26 January 2013.

##### Required:

- The stock price on 13 November 2012. (2 marks)
- Justify why the option's price would not fall below its intrinsic value. (4 marks)
- Advise an option holder in bank X on whether to exercise the call option prior to the ex-dividend date. (3 marks)

- (b) The current stock price of Waumini Enterprises is Sh.60. The exercise price of an American call option written on the stock is Sh.53. The annual interest free rate is 14%. The option matures in 90 days. The variance of the stock is estimated to be 30% per annum.

Assume that the stock will pay no dividends and also will not provide any other capital distribution.

##### Required:

The value of the call option.

(5 marks)

Note: use a  $d_1$  value of 0.46.

*cheaply cheap*

- (c) The following is an extract from a recent edition of an international financial journal:

"Portfolio insurance is an attempt to protect the values of a stock portfolio in the event of a large downward move in the stock market. If you use options to insure a portfolio, you can continue to make money if the stocks in the portfolio continue to increase in value, but not lose money if the stocks fall in value".

##### Required:

In the context of the above extract, summarise six steps you would follow in the process of insuring a portfolio with options.

(6 marks)

(Total: 20 marks)

#### QUESTION TWO

- (a) Discuss three advantages and three disadvantages of property derivatives. (12 marks)
- (b) A 10-month forward contract on a stock whose current price is Sh.50 is given to you for consideration. Assume that

the interest rate (risk free) continuously compounded is 8% per annum for all maturities. Dividends of Sh.0.75 per share are expected after 3 months, 6 months and 9 months respectively.

##### Required:

- Present value of the dividends. (3 marks)
- The forward price. (3 marks)
- Explain the condition that is necessary to eliminate any arbitrage opportunities in the above scenario. (2 marks)

(Total: 20 marks)

#### QUESTION THREE

- (a) Option spreads are the basic building blocks of many options trading strategies. Investors can choose from among various classes of spreads in designing their trading strategies.

##### Required:

With reference to the above statement, explain the following classes of option spreads:

- Vertical option spreads. (2 marks)
- Horizontal option spreads. *buy sell* (2 marks)
- Diagonal option spreads. (2 marks)

- (b) Jacob Andrews is a currency speculator in the international financial markets. He is based in Zurich, Switzerland. He speculates in the spot, forward and option markets.

Assume that the Swiss Franc (SF) is quoted at the following exchange rates for the United States dollar (US \$):

Spot rate US \$ 0.5851/SF.

Six months forward rate US \$ 0.5760/SF.

Jacob Andrews holds US \$100,000 for speculation and he believes that in six months time the spot rate will be US \$ 0.6000/SF.

##### Required:

- Show how Jacob Andrews could speculate in the spot and forward markets indicating the expected profits under each market. (12 marks)
- Justifying your answer, state which of the two markets Jacob Andrews should speculate in. (2 marks)

(Total: 20 marks)

#### QUESTION FOUR

- (a) Distinguish between the following terms as used in financial markets:

- Convertible loan stocks and warrants. *bring bank* (4 marks)
- Eurobonds and interest rate swaps. *Euro bond* (4 marks)

- (b) A company based in Kenya owes another company based in Uganda a sum of Uganda Shillings (Ush) 95 million which is payable in three months time from the present.

The following additional information is provided:

- The spot exchange rate is Ush/Ksh 27.5509 - 27.5548.
- The money market borrowing rate in Kenya and Uganda is 8% and 10% per annum respectively.

##### Required:

Show how the Kenyan company could utilise a money market hedge to control the sum payable to the Ugandan company.

(12 marks)

#### QUESTION FIVE

- (a) Discuss six policy options that could be adopted to reduce systemic risk and improve the efficiency of the derivatives markets. (12 marks)

- (b) An investor has obtained the following quotes for options on a share worth Sh.61:

Call option: Sh.6.

Put option: Sh.2.

The three months risk free rate is 6% compounded semi-annually. Both options have a share price of Sh.60 and an expiration date of three months.

Assume that all options are European type options.

##### Required:

Show how this investor could hedge against the share price.

(3 marks)

2



FRIDAY: 30 May 2014.

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) Explain the following terms as used in the analysis of derivatives:

- (i) Forward commitment. (2 marks)
- (ii) Contingent claim. (2 marks)
- (iii) Forward rate agreement (FRA). (2 marks)

(b) Examine three ways of terminating a futures contract at or prior to its expiration. (6 marks)

(c) (i) A 1.2-year futures contract has a fixed income underlying treasury bond with the following characteristics:

1. Coupon rate of 7% paid semi-annually.
2. 10 years to maturity.
3. Par value of Sh.1,000.
4. Current price of Sh.1,040.

The annual risk-free rate is 5%.

**Required:**

The no arbitrage price of the treasury bond future contract. (4 marks)

(ii) A 120-day future on a stock is currently priced at Sh.30 and is expected to pay a dividend of Sh.0.40 in 15 days and Sh.0.40 in 105 days.

**Additional information:**

1. The annual risk free rate is 5%.
2. The yield curve is flat.

**Required:**

The no-arbitrage price of the stock future price. (4 marks)

(Total: 20 marks)

**QUESTION TWO**

(a) Explain the following terms as used in options markets and contracts:

- (i) Interest rate cap. (2 marks)
- (ii) Interest rate floor. (2 marks)
- (iii) Interest rate collar. (2 marks)

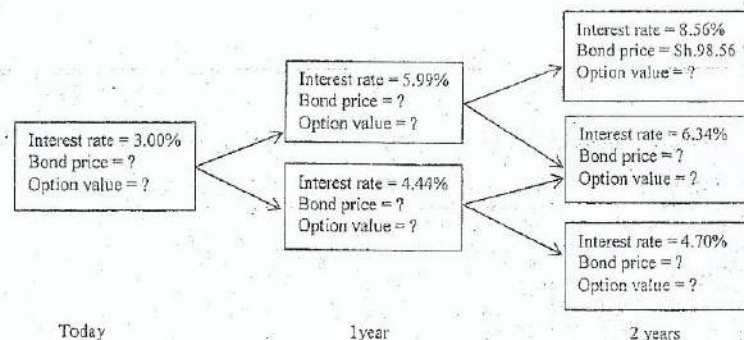
(b) Evaluate three limitations of the Black-Scholes-Merton (BSM) model of option valuation. (6 marks)

(c) You have been provided with a European call option having the following features:

1. Two years to expiration and a strike price (call price) of Sh.100.00.
2. The underlying asset of an option is a Sh.100.00 par value, 7% annual coupon bond with three years to maturity.

The following figure represents the first two years of the binomial tree for valuing the option's underlying bond.

Two-period binomial tree for the option's price:



**Required:**

The missing data in the above two-period binomial tree. (8 marks)

(Total: 20 marks)

**QUESTION THREE**

(a) Highlight five similarities between swaps and forwards. (5 marks)

(b) Discuss three primary uses of swaps. (6 marks)

(c) CBAK Bank, a multinational bank, entered into a 1-year currency swap with quarterly payments 200 days ago by agreeing to swap 1,000,000 US dollars (\$) for 800,000 Euros (€). CBAK Bank agreed to pay an annual fixed rate of 5% on the €800,000 and receive a floating rate tied to LIBOR on the \$1,000,000. Current LIBOR and Euribor rates and present value factors are shown below:

	Rate (%)	Present value factor
70-day LIBOR	4.0	0.9923
90-day LIBOR	4.4	0.9891
160-day LIBOR	4.8	0.9791
180-day LIBOR	5.2	0.9747
70-day Euribor	5.2	0.9900
90-day Euribor	5.6	0.9900
160-day Euribor	6.1	0.9736
180-day Euribor	6.3	0.9695

**Additional information:**

1. The current spot exchange rate is €0.75 per \$.
  2. The 90 day LIBOR at the last payment date was 4.2%.
- NB: LIBOR is the London interbank offer rate while Euribor is the Euro interbank offer rate.

**Required:**

The value of the swap to the CBAK bank today. (9 marks)

(Total: 20 marks)

**QUESTION FOUR**

(a) Using well labelled diagrams, illustrate how the following risk measures are used in the sensitivity analysis of call and put options:

- (i) Delta. (3 marks)
- (ii) Vega. (3 marks)
- (iii) Theta. (3 marks)

(b) Evaluate the following options portfolio risk management strategies:

- (i) Bull spread strategy. (2 marks)
- (ii) Bear spread strategy. (2 marks)
- (iii) Box spread strategy. (2 marks)

(c) In 60 days, BTA bank plans to lend Sh.10 million for 90 days.

**Additional information:**

1. The lending rate is LIBOR + 200 basis points.
2. The current LIBOR is 4%.



3. The bank buys a put that matures in 60 days with a notional principal of Sh.10 million, 90 days in underlying, and a strike rate of 5%.
4. The put premium is Sh.2,000.

**Required:**

The effective annual rate of the loan, if at expiration, the LIBOR is 4.5%.

(5 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) Evaluate five reasons why investors could choose to trade options on futures (futures options) rather than options on the underlying assets. (10 marks)
- (b) Danlope Holdings, a multinational corporation based in the United States of America (USA) expects to receive 150 million euros (EUR) six months from now. The company enters into a cash settlement currency forward contract to exchange the EUR 150 million for US dollars at USD 1.20 per euro. The market exchange rate is USD 1.22 per euro settlement.

**Required:**

The amount of the payment to be received or paid by Danlope Holdings at settlement.

(4 marks)

- (c) The risk-free rate in the United States of America (USA) and Mexico are 6% and 8% respectively. The current spot exchange rate is USD 0.0845 per Mexican peso (MXN).

Assume one year has 365 days.

**Required:**

- (i) The forward exchange rate of a 180-day forward contract. (3 marks)
- (ii) The value of the forward contract if, after 15 days, the spot rate is USD 0.0980 per Mexican peso (MXN). (3 marks)

(Total: 20 marks)



FRIDAY: 6 December 2013.

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) Explain the following terms as used in futures markets.
- (i) Expectations hypothesis. (2 marks)
  - (ii) Normal backwardation. (2 marks)
  - (iii) Normal contango. (2 marks)
- (b) NDK Bank holds a Sh.5 million loan at a fixed rate of 6% for three years, with quarterly payments. Due to changing interest expectations, the bank has decided to fund the loan at a floating rate. Although it cannot change the terms of the loan to the borrower, it can effectively convert the loan to a floating rate loan by using a swap. The fixed rate on three-year swaps with quarterly payments at LIBOR is 7%.

Assume 90 days in a quarter and 360 days in a year.

**Required:**

- (i) Explain how the bank could convert the fixed rate loan to a floating rate loan using a swap. (4 marks)
  - (ii) Explain why the floating rate on the loan will be less than the LIBOR. (4 marks)
- (c) Describe three challenges encountered by dealers when delta hedging their options in the options market. (6 marks)
- (Total: 20 marks)

**QUESTION TWO**

- (a) An underlying asset has a current price of Sh.300. This price could increase by 14% or reduce by 11% in two periods. The risk free rate is 3% per period.

**Required:**

- (i) The value of a European call option expiring in two periods with an exercise price of Sh.300 using a two-period binomial model. (12 marks)
  - (ii) Number of units of the underlying asset that would be required at each point in the binomial tree to construct a risk free hedge using 10,000 calls. (3 marks)
- (b) Summarise five inputs of the Black Scholes-Merton model. (5 marks)
- (Total: 20 marks)

**QUESTION THREE**

- (a) Distinguish between a "call provision" and a "callable bond". (4 marks)

- (b) The following information represents data relating to a certain stock:

	Sh.
Stock price	11,000
Call price (six month maturity, $x = \text{Sh.10,500}$ )	1,700
Put price (six month maturity, $x = \text{Sh.10,500}$ )	500
Risk free interest rate	10% per year

**Required:**

Determine whether the parity condition holds in the above scenario. (3 marks)

- (c) Consider two companies, Ace Ltd. and Base Ltd. Ace Ltd. must pay Kenya shillings (Ksh.) 100 million in March 2014 for imports from Britain, while Base Ltd. will receive Ksh.300 million in March 2014 from exports to Britain.

The following exchange rates are provided:

	Ksh/£
Spot rate	126
March 2014 forward exchange rate	131
Size of futures contract	Ksh.6,250,000

**Required:**

- (i) Ace Ltd.'s best hedging strategy and the results. (3 marks)
- (ii) Base Ltd.'s best hedging strategy and the results. (2 marks)

- (iii) If the exchange rate turns out to be Ksh.135/£ in March 2014, calculate the results in (c) (i) and (c) (ii) above if the companies will not have hedged. (2 marks)

- (d) Summarise three circumstances under which a financial institution could be said to be explicitly or implicitly offering a product involving an interest rate option. (6 marks)

(Total: 20 marks)

**QUESTION FOUR**

- (a) Distinguish between the following terms in relation to derivative markets:

- (i) "Total return swap" and "convenience yield". (2 marks)
- (ii) "Strip hedge" and "stack hedge". (2 marks)

- (b) Summarise two factors that influence the value of the issuer's right to call when determining the value of a callable convertible bond. (2 marks)

- (c) The South African Rand (R) currently trades at Sh.10.76. The risk free rates in Kenya and South Africa are 4.5% and 2% respectively. The 3-month forward rate on the South African Rand is quoted at Sh.10.85.

**Required:**

Risk free profit that could be earned from engaging in a forward contract. (8 marks)

- (d) Mambo Pension Fund has a large portfolio of corporate and government bonds. The market value of the bond portfolio is Sh.50 million. The duration of the portfolio is 9.52. An analyst has advised that the chance of an upward shift in interest rates in the near term is greater than what the market currently perceives. In view of this, the pension fund has decided to reduce the duration of its bond portfolio to 7.5 by using a futures contract priced at Sh.100,000 that has a duration of 8.47.

Assume that the conversion factor for the futures contract is 1.1.

**Required:**

- (i) Explain whether the pension fund needs to buy or sell futures contracts. (2 marks)
- (ii) Determine the number of futures contracts that would be needed to change the duration of the bond portfolio. (4 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) The derivatives markets are not well established in developing countries.

Discuss five factors that could have contributed to the above situation. (10 marks)

- (b) Explain two circumstances under which a short-hedge and a long-hedge might be appropriate to hedgers. (4 marks)

- (c) A bond manager expects that interest rates will rise and decides to protect the value of his portfolio by entering into a one year pay fixed, receive floating LIBOR interest rate swap described below:

**LIBOR interest rate swap**

1 year fixed rate (annualised)	1.5%
90 days LIBOR rate [LO(90)] (annualised)	1.1%
Notional principal	Sh.1,000,000
Days count convention	90/360

Sixty days have passed since initiation of the swap and interest rates have changed. The manager would like to know the value of the swap.

The LIBOR term structure is provided below:

**LIBOR term structure (60 days after swap initiation)**

Annualised rates

L60(30)	= 1.25%
L60(120)	= 1.50%
L60(210)	= 1.75%
L60(300)	= 2.00%

**Required:**

The market value of the interest rate swap entered into by the manager at sixty days after the initiation of the swap and using a Sh.1,000,000 notional principal.

Note: Round your figures to 4 decimal places.

(5 marks)

(Total: 20 marks)

10



MONDAY: 10 June 2013.

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) Explain the following option market terminologies:

- (i) Open interest. (3 marks)
- (ii) Rho. (2 marks)
- (iii) Gamma. (3 marks)

(b) Consider a call option on a non-dividend paying stock where the stock price is Sh.49, the strike price is Sh.50, the risk free rate is 5%, the time to maturity is 20 weeks (= 0.3846 years) and the volatility is 20%.

Required:

- (i) The option's vega. (2 marks)
- (ii) Explain the implications of the option's vega calculated in (b)(i) above. (2 marks)

(c) Summarise four uses of interest rate swaps. (4 marks)

(d) A six year government bond with a Sh.1 par value, pays a 6% semi-annual coupon and trades at par. A future's contract expiring in 15 months calls for delivery of a bond with a conversion factor of 1.0567. The risk free rate is 5%.

Required:

- The appropriate future price. (4 marks)
- (Total: 20 marks)

**QUESTION TWO**

(a) XYZ Ltd. plans to borrow Sh.10 million in 30 days at 90 days LIBOR plus 100 basis points. The company purchases a forward rate agreement (FRA) at a rate of 6%. This contract expires in one month (30 days) and the underlying eurodollar matures four months (120 days) from now. Thirty days later, LIBOR is 7.5%.

Required:

- The effective borrowing rate of XYZ Ltd. (4 marks)

(b) Evaluate four derivative strategies used to enhance return and risk management in a portfolio. (8 marks)

(c) Summarise three exchange traded interest rate options. (3 marks)

(d) Jalomy Motors Ltd. a Kenyan corporation, imports vehicles from Europe and Japan. These business transactions generate exchange rate risk between the Kenya Shilling (Ksh.) and both the Euro (EUR) and Japanese Yen (JPY). In order to hedge the exchange rate risk, the management of Jalomy Motors Ltd. endorses the use of currency forwards and options.

Jalomy Motors Ltd. is in long forward contract of 5 million Euros at an exchange rate of EUR/Ksh.119 expiring in six months. The company also has long 100 Japanese Yen (JPY) put options with expiration in six months with a strike price of 71.68 JPY/Ksh. and a contract size of 1.25 million Japanese Yen (JPY).

The current spot exchange rates are EUR/Ksh.121 and 73 JPY/Ksh. All of Jalomy Motors' Ltd. currency derivatives are traded over the counter with Apple bank. The key interest rates are provided below:

Six months risk free interest rates (annualised)

Ksh.	9.0%
EUR	4.5%
JPY	1.0%

Required:

- (i) The amount at risk from a credit loss on the long Euro forward contract. (3 marks)
  - (ii) Determine which party bears the credit risk. (2 marks)
- (Total: 20 marks)

**QUESTION THREE**

(a) Analyse five risks facing an interest rate and currency swap dealer. (10 marks)

(b) A Sh.250 million bond portfolio has a duration of 5.50. The portfolio manager wants to reduce the duration to 4.50 by using a swap. Consider the possibility of using a one year swap with monthly payments or a 2 year swap with semi-annual payments.

Required:

- (i) The durations of the 2 swaps under the assumption of fixed payment and floating receipts (Assume that the duration of a fixed-rate bond is 75% of its maturity). (5 marks)
  - (ii) Choose the swap with the longer absolute duration and determine the notional principal of the swap necessary to change the duration to 4.50. Explain your results. (5 marks)
- (Total: 20 marks)

**QUESTION FOUR**

(a) Outline three arguments against hedging. (3 marks)

(b) With the aid of a graph, plot a straddle clearly indicating value and profit at expiration. (2 marks)

(c) Total Asset Strategies Ltd. will receive Sh.6 million at a later date but wants to proceed and take a position of Sh.3 million in stocks and Sh.3 million in bonds. The desired stock beta is 1.0 and the desired bond duration is 6.2. A stock index futures contract is priced at Sh.195,000 and has a beta of 0.97. A bond futures contract is priced at Sh.110,000 and has an implied modified duration of 6.0. When the futures contract expires, the stock index future price is Sh.185,737.50 and the bond future price is Sh.112,090.

Required:

- The profit or loss on the futures position. (9 marks)

(d) In relation to option strategies, discuss three types of money spreads. (6 marks)

(Total: 20 marks)

**QUESTION FIVE**

(a) Kenneth Njoroge is a portfolio manager for a commodity investment fund. He observes higher economic growth in the global market and the resulting higher demand for commodities. He further investigates trading opportunities in the oil market. The spot price is Sh.90.13 per barrel and the three month forward contract price is Sh.89.27 per barrel. Mr. Njoroge decides to implement a reverse cash and carry arbitrage to profit from the difference between the spot and forward price. He can borrow or lend cash at 5% and the lease rate for oil is 6%. These are continuously compounded interest rates.

Required:

- (i) Describe the two components of the synthetic commodity position in this arbitrage. (4 marks)
- (ii) Compute Kenneth Njoroge's profit on a reverse cash and carry arbitrage in the oil market. (6 marks)

(b) Summarise four functions of derivative markets. (4 marks)

(c) Discuss three methods of currency hedging. (6 marks)

(Total: 20 marks)





VALUATION AND ANALYSIS OF DERIVATIVES

FRIDAY: 7 December 2012.

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) Assume that on 12 November 2012, the stock of bank X was selling at Sh.44.20 per share. January 2013 call options were standing at an exercise price of Sh.30.

Additional information:

1. The bank was expected to go ex-dividend with a dividend pay-out of Sh.5.60 per share on 13 November 2012.
2. The risk free rate of interest is 14%.
3. The maturity date of the options is 26 January 2013.

Required:

- (i) The stock price on 13 November 2012. (2 marks)
- (ii) Justify why the option's price would not fall below its intrinsic value. (4 marks)
- (iii) Advise an option holder in bank X on whether to exercise the call option prior to the ex-dividend date. (3 marks)

- (b) The current stock price of Wamini Enterprises is Sh.60. The exercise price of an American call option written on the stock is Sh.53. The annual interest free rate is 14%. The option matures in 90 days. The variance of the stock is estimated to be 30% per annum.

Assume that the stock will pay no dividends and also will not provide any other capital distribution.

Required:

The value of the call option. (5 marks)

Note: use a  $d_1$  value of 0.46.

- (c) The following is an extract from a recent edition of an international financial journal:

"Portfolio insurance is an attempt to protect the values of a stock portfolio in the event of a large downward move in the stock market. If you use options to insure a portfolio, you can continue to make money if the stocks in the portfolio continue to increase in value, but not lose money if the stocks fall in value".

Required:

In the context of the above extract, summarise six steps you would follow in the process of insuring a portfolio with options. (6 marks)

(Total: 20 marks)

QUESTION TWO

- (a) Discuss three advantages and three disadvantages of property derivatives. (12 marks)

- (b) A 10-month forward contract on a stock whose current price is Sh.50 is given to you for consideration. Assume that the interest rate (risk free) continuously compounded is 8% per annum for all maturities. Dividends of Sh.0.75 per share are expected after 3 months, 6 months and 9 months respectively.

Required:

- (i) Present value of the dividends. (5 marks)
- (ii) The forward price. (3 marks)
- (iii) Explain the condition that is necessary to eliminate any arbitrage opportunities in the above scenario. (2 marks)

(Total: 20 marks)

QUESTION THREE

- (a) Option spreads are the basic building blocks of many options trading strategies. Investors can choose from among various classes of spreads in designing their trading strategies.

Required:

With reference to the above statement, explain the following classes of option spreads:

- (i) Vertical option spreads. (2 marks)
- (ii) Horizontal option spreads. (2 marks)

- (iii) Diagonal option spreads. (2 marks)

- (b) Jacob Andrews is a currency speculator in the international financial markets. He is based in Zurich, Switzerland. He speculates in the spot, forward and option markets.

Assume that the Swiss Franc (SF) is quoted at the following exchange rates for the United States dollar (US \$):

Spot rate US \$ 0.5851/SF.

Six months forward rate US \$ 0.5760/SF.

Jacob Andrews holds US \$100,000 for speculation and he believes that in six months time the spot rate will be US \$ 0.6000/SF.

Required:

- (i) Show how Jacob Andrews could speculate in the spot and forward markets indicating the expected profits under each market. (12 marks)

- (ii) Justifying your answer, state which of the two markets Jacob Andrews should speculate in. (2 marks)  
(Total: 20 marks)

QUESTION FOUR

- (a) Distinguish between the following terms as used in financial markets:

- (i) Convertible loan stocks and warrants. (4 marks)
- (ii) Eurobonds and interest rate swaps. (4 marks)

- (b) A company based in Kenya owes another company based in Uganda a sum of Uganda Shillings (Ush) 95 million which is payable in three months time from the present.

The following additional information is provided:

1. The spot exchange rate is Ush/Ksh 27.5509, 27.5548.
2. The money market borrowing rate in Kenya and Uganda is 8% and 10% per annum respectively.

Required:

Show how the Kenyan company could utilise a money market hedge to control the sum payable to the Ugandan company. (12 marks)

(Total: 20 marks)

QUESTION FIVE

- (a) Discuss six policy options that could be adopted to reduce systemic risk and improve the efficiency of the derivatives markets. (12 marks)

- (b) An investor has obtained the following quotes for options on a share worth Sh.61:

Call option: Sh.6.

Put option: Sh.2.

The three months risk free rate is 6% compounded semi-annually. Both options have a share price of Sh.60 and an expiration date of three months.

- (c) Assume that all options are European type options.

Required:

Show how the investor could hedge against the share price using options. (8 marks)

(Total: 20 marks)

12





MONDAY: 4 June 2012.

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) One of your colleagues who trades in options on bond futures argues that there is a difference between using European style and American style currency options:

**Required:**

Giving two reasons, support your colleague's argument.

(4 marks)

- (b) The n-year spot rate of interest is given by:

$$y_n = 0.03 + \frac{n}{1000} \text{ for } n = 1, 2, 3 \text{ and } 4.$$

**Required:**

Calculate the implied one-year and two year forward rates applicable at time  $t = 2$ .

(4 marks)

- (c) A nondividend-paying stock,  $S_t$ , has a current price of Sh.200. After 6 months, the price of the stock could increase to Sh.230 or decrease to Sh.170. After a further 6 months, the price could increase from Sh.230 to Sh.250 or decrease from Sh.230 to Sh.200. From Sh.170, the price could increase to Sh.200 or decrease to Sh.150. The semi-annually compounded risk-free rate of interest is 6% per annum and the real world probability that the share price increases at any time is 0.75.

**Required:**

Using the binomial tree approach, calculate the state-price deflators after one year.

(6 marks)

- (d) Some financial institutions which do not have an "AAA" credit rating could set up a special subsidiary with an "AAA" rating for the purpose of trading derivatives.

Discuss three characteristics of such subsidiaries which could enable them to achieve an "AAA" credit rating.

(6 marks)

(Total: 20 marks)

**QUESTION TWO**

- (a) Discuss two methods that an investment bank could use to mitigate the risk of default in a derivatives contract.

(6 marks)

- (b) A company based in Kenya, K Ltd., owes a company based in Uganda, U Ltd., Uganda shillings (Ush.)112,546,341.50 which is to be paid in three month's time. The spot exchange rate today is currently Ush./Ksh.27.5509 - 27.5548.

Interest rates in the money markets are currently 10% and 12% per annum in Kenya and Uganda respectively.

**Required:**

- (i) Describe how K Ltd. could use a money market hedge to cover its currency risk exposure.

(10 marks)

- (ii) Apart from hedging, briefly explain two different ways that K Ltd. could use to minimise the currency risk exposure.

(4 marks)

(Total: 20 marks)

**QUESTION THREE**

- (a) Briefly explain the following terms as applied in swap transactions:

- (i) Callable coupon swap.

(2 marks)

- (ii) Swaptions.

(2 marks)

- (b) Distinguish between "hedging" and "speculation".

(6 marks)

- (c) The table below shows the current prices of zero coupon bonds and their yields (with simple-return annual compounding) in shillings:

Maturity period (years)	Yield on zero coupon bonds (%)	Implied forward rates (%)	Zero prices
1	2.40	2.400	0.97656
2	2.80	3.202	0.94627
3	3.20	4.005	0.90983
4	3.50	4.405	0.87144

The implied forward rate is for one year periods which end at the stated maturities.

**Additional information:**

- Three years ago, a company entered into an interest rate swap receiving 4% per annum fixed interest with annual compounding and paying at the 182-day treasury bill rate on a notional of shillings 100 million. The swap has a remaining life of four years. All interest rates are risk free.
- The one year forward rate is equal to the 182-day treasury bill rate. Ignore credit risk.

**Required:**

- (i) Determine the values of the two bonds involved (the floating and the fixed rate bond), assuming that both have just paid their coupons.

(4 marks)

- (ii) Determine the value of the interest rate swap resulting from your analysis in (c) (i) above. Round your figures in shillings to 2 decimal places.

(2 marks)

- (iii) Show that the value of the swap is unchanged if you decompose it into a portfolio of forward contracts.

(4 marks)

(Total: 20 marks)

**QUESTION FOUR**

- (a) Consider an investor who buys a European call option to purchase 10,000 shares of XYZ Limited with a strike price of Sh.40. The shares currently trade at Sh.38 while the call option expires in four months' time.

**Required:**

Assuming that the premium is Sh.0.50 per option to purchase a share, determine the profit on exercising the option if in four months' time, the shares sell at Sh.55 each.

(4 marks)

- (b) Duru Ltd. has total assets worth Sh.100 million. Equity capital constitutes of 2.5 million ordinary shares with a market value of Sh.24 each. The company has just made an issue of debentures of Sh.100 nominal value for a total of Sh.25 million with a warrant of Sh.1 for each debenture. The warrant will entitle a debenture holder to apply for one ordinary share at an exercise price of Sh.25 each at the end of 2 years.

Assume that the shares variability (standard deviation) is 10% and interest rates average 12% in the market.

**Required:**

The value of the warrant.

(10 marks)

- (c) Citing examples, describe the following investments as applied in commodity markets:

- (i) Direct commodity investment.

(3 marks)

- (ii) Indirect commodity investment.

(3 marks)

(Total: 20 marks)

**QUESTION FIVE**

- (a) (i) Briefly explain the term "credit default swap".

(2 marks)

- (ii) Describe the application of credit default swaps in financial markets.

(4 marks)

- (iii) When entering into a credit default swap, both the buyer and seller of credit protection take on counterparty risk.

Citing relevant examples, elaborate on the above statement.

(4 marks)

- (b) Discuss five incentives that the government of your country could provide to promote the growth of a derivatives market.

(10 marks)

(Total: 20 marks)

13



## VALUATION AND ANALYSIS OF DERIVATIVES

FRIDAY: 2 December 2011.

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) Describe how the following factors could affect the value of stock options:

- (i) Volatility of future stock prices. (3 marks)
- (ii) The risk free interest rate. (3 marks)
- (iii) Time to expiration. (3 marks)

(b) The following were the closing prices of Standard & Poor's futures traded at an international mercantile exchange:

Date		Closing prices
31 December 2010		979.10
January 2011	2	984.70
January 2011	5	986.90
January 2011	6	971
January 2011	7	974
January 2011	8	961.2
January 2011	9	929
January 2011	12	945.5
January 2011	13	959.5
January 2011	14	963.3
January 2011	15	955.10
January 2011	16	968.4
January 2011	20	985.20
January 2011	21	975.40

## Required:

Assuming that there are 250 trading days in a year, determine the five day volatility of the futures prices. (11 marks)

(Total: 20 marks)

## QUESTION TWO

- (a) Citing three reasons, argue the case for hedging as a risk management tool. (6 marks)
- (b) A farmer is expecting to harvest 20,000 bags of maize in December 2011. Assume that the price of maize per bag in November 2011 was Sh.2,300. The farmer is worried that the price of maize could fall in December 2011 to Sh.2,000 per bag. He intends to hedge against the risk of falling prices using a futures contract.

## Required:

Evaluate how the farmer could hedge against the above risk assuming that December 2011 futures for maize are quoted at Sh.2,100 per bag. (6 marks)

- (c) Giving two examples in each case, distinguish between "funded" and "unfunded" credit derivatives. (8 marks)

(Total: 20 marks)

## QUESTION THREE

(a) Explain the following terms as they relate to convertible bonds:

- (i) Conversion price. (2 marks)
- (ii) Conversion ratio. (2 marks)
- (iii) Conversion premium. (2 marks)

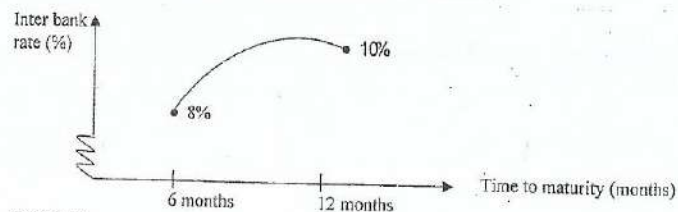
(b) Differentiate between "vanilla convertible bonds" and "contingent convertible bonds". (4 marks)

(c) GI Ltd. wishes to enter into a swap contract which pays cashflows based on a floating rate and receives cashflows based on a fixed rate. GI Ltd. requested a quote from DSP Bank Ltd. and received the following quotation:

Maturity	1 year
Floating index	six months inter bank rate
Fixed coupon	%
Payment frequency	semi-annual
Day count	30/360

## Additional information:

- The principal amount was Sh.100,000.
- The inter bank rate yield curve was estimated as follows:



## Required:

The appropriate one year fixed rate, in percentage, that DSP Bank Ltd. should quote.

(10 marks)

(Total: 20 marks)

## QUESTION FOUR

- (a) An investor has just purchased a six-months call option on a share at an exercise price of Sh.100 (premium Sh.5). The investor has also purchased a put option on the same share at an exercise price of Sh.80 (premium Sh.3).

## Required:

Assuming that the current market price per share is Sh.90, determine the investor's position six months from now if the share price turns out to be:

- (i) Sh.100. (4 marks)
- (ii) Sh.60. (4 marks)

(b) The following quotations were extracted from an international financial journal on 21 October 2011:

Spot rate (Sh./US \$)	91.6173
One year inter bank rate: United States of America	0.03700
Kenya	0.09750

## Required:

Determine the forward rate that a bank should quote for a client intending to enter into a futures contract. (3 marks)

(c) A speculator purchased 10 futures contracts on a share at Sh.65 per share. The contracts mature in 9 months time. Each contract was for 1,000 shares. The 91-day treasury bill rate is 9%.

## Required:

Assuming that the speculator posted a 100% margin in the form of riskless securities, calculate:

- (i) The value of the margin at maturity. (3 marks)
- (ii) The value of the futures contract on maturity. (3 marks)
- (iii) The speculator's actual return. (3 marks)

(Total: 20 marks)

## QUESTION FIVE

- (a) The issue of distressed securities has not been clearly understood especially in developing and emerging financial markets.

## Required:

- (i) Explain the meaning of the term "distressed securities". (2 marks)
- (ii) Identify three possible buyers of distressed securities. (3 marks)
- (iii) Assess two ways in which long term investors could safeguard their interests in a firm with distressed securities. (2 marks)



- (b) Discuss three fundamental requirements for the successful introduction and growth of a derivatives market in a country. (9 marks)  
(Total: 20 marks)

**KASNEB**

CSIA PART III SECTION 6 C163

**VALUATION AND ANALYSIS OF DERIVATIVES**

TUESDAY: 7 June 2011.

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) "Valuation of forward contracts is critical in derivatives management".

Citing four reasons, support the above statement.

(4 marks)

- (b) The following information relates to a forward contract on a company's shares:

- The current market price is Sh.280 per share.
- The expected dividend per share is Sh.5.
- The first dividend is due in 26 days' time from the present. The second dividend is due in 130 days' time.
- The expected maturity date is 120 days from the present.
- The risk free rate is 4%.

An investor decides to take a short position in a 120-days forward contract on a share of the company.

**Required:**

Estimate the value of the forward contract on the 30<sup>th</sup> day assuming that the share price on that day will be Sh.256 per share. (6 marks)

- (c) You are currently evaluating a 15-year Sh.1,000,000 government bond. The bond pays interest semi-annually at the rate of 7% per annum and has a conversion factor of 1.52. From your analysis, you estimate that the yield of the bond should be 7% annually.

**Additional information:**

- The coupon interest on the bond has just been paid.
- The risk free rate is 6%.
- A 15-months' futures contract exists on the bond.

**Required:**

Estimate the price of the 15-month's futures contract on the bond.

(6 marks)

- (d) The following information was extracted from the financial pages of an international newspaper:

Strike price	Calls-last			Puts-last		
	March	April	May	March	April	May
64	r	s	s	0.01	0.08	0.16
65	r	r	s	0.02	0.15	0.28

Prev. day calls vol. 2,837, Open int. 102,684  
Prev. day puts vol. 13,521, Open int. 52,977

**Required:**

Interpret the meaning of each of the bolded items.

(4 marks)

(Total: 20 marks)

**QUESTION TWO**

- (a) Briefly explain the following terms in the context of options:

(i) Rho.

(2 marks)

(ii) Theta.

(2 marks)

- (b) The following information is available on an option:

Put price	Sh.11
Call price	Sh.5
Exercise price	Sh.60
Forward price	Sh.55
Days to expiration	170
Risk free rate	5%

**Required:**

- (i) Using put-call-forward parity approach, estimate the prices of a synthetic call option, synthetic put option and synthetic forward contract. (4 marks)
- (ii) For each of the prices estimated in (b) (i) above, determine any over or under-pricing of the option. (3 marks)
- (c) (i) Citing relevant examples, briefly explain the term "revolving lines of credit". (3 marks)
- (ii) Summarise six characteristics of revolving lines of credit. (6 marks)
- (Total: 20 marks)

**QUESTION THREE**

- (a) Analyse the distinction between a "payer's swaption" and a "receiver's swaption". (6 marks)

- (b) A company holds a one-year Sh.20 million receiver's swaption with an exercise rate of 7% per annum. This swaption is however nearing maturity.

The company is considering another two-year swaption with semi-annual interest payment for the same amount. The discount factors over the two-year period are as follows:

Period (days)	Discount factor
180	0.9776
360	0.9499
540	0.9144
720	0.8826

**Required:**

- (i) Assess whether the current one-year swaption is in the money. (4 marks)
- (ii) Estimate the value of the two-year swaption on maturity. (4 marks)
- (c) (i) Briefly describe how interest rate caps operate. (3 marks)
- (ii) Justifying your reasoning, identify the main category of borrowers likely to prefer interest rate caps. (3 marks)
- (Total: 20 marks)

**QUESTION FOUR**

- (a) As an option trader, you are considering strategies based upon buying and selling options on a petroleum futures contract with a current price of Sh.400. The volatility of the futures contract is currently around 45%. You have two mutually exclusive potential strategies to choose from as outlined below:

**Strategy A**

An at-the-money "straddle" consisting of simultaneous purchase of a call and a put, but with a strike price of Sh.400.

**Strategy B**

An at-the-money "strangle" consisting of simultaneous purchase of a call with a strike price of Sh.500 and a put with a strike price of Sh.320.

Assume that all the options expire in three months' time from now and the nominal amounts for each purchased option would be the same.

**Required:**

- (i) Draw the approximate profit or loss diagrams for each strategy against the price of the underlying future showing the profit or loss now and at expiry of each strategy. (8 marks)
- (ii) Outline three factors that you might take into account under each strategy in making your decision. (6 marks)
- (b) Commodity swaps are emerging as popular derivatives in the global financial markets.



**Required:**  
Describe three features of commodity swaps.

(6 marks)  
(Total: 20 marks)

#### QUESTION FIVE

- (a) Briefly explain the term "currency futures". (4 marks)
- (b) Describe the concept of value at risk (VaR) as used in finance. (4 marks)
- (c) (i) Explain four applications of VaR in finance. (8 marks)
- (ii) Argue the case against VaR in risk management. (4 marks)
- (Total: 20 marks)

#### CSIA PART III SECTION 6

#### VALUATION AND ANALYSIS OF DERIVATIVES

FRIDAY: 3 December 2010.

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) Consider a stock paying a dividend at a rate denoted by  $\delta$ . The stock's price at any time  $t$  is denoted by  $s_t$ . The dividend earned between times  $t$  and  $T$ , where  $T \geq t$ , is expressed as  $S_t(e^{(T-t)\delta} - 1)$ . Let  $C_t$  and  $P_t$  be the price at time  $t$  of a European call option and European put option respectively, written on the stock  $S$ , with strike price  $K$  and maturity  $T \geq t$ . The instantaneous risk-free rate is denoted by  $r$ .

**Required:**

Prove the existence of put-call parity in this context by adopting the proof of standard put call parity that applies to put and call options on a non-dividend paying stock. (8 marks)

- (b) A bull spread is the simultaneous purchase of a call option of a given strike and maturity and a sale of a second call option of the same maturity but with a higher strike.

Assume that a bull spread is purchased on a commodity priced at Sh.250, with two strikes of Sh.230 and Sh.270 and expiry date six months from today. Implied volatility is at 35% and risk-free rate is zero.

**Required:**

- (i) Discuss the conditions under which a trader or hedger might wish to purchase a bull spread on a commodity. (4 marks)
- (ii) Sketch the value of the bull spread against a range of commodity prices, showing the situation as at today and just before expiry. (4 marks)
- (c) Refer to (b) (ii) above. Explain how the value of the bull spread at a given commodity price would change:
- (i) If volatility falls to 25%. (2 marks)
- (ii) A month from today. (2 marks)
- (Total: 20 marks)

#### QUESTION TWO

- (a) East African Capital Markets Association intends to set up a suite of derivatives on commodities.

**Required:**

Explain three characteristics needed in a commodities index before an exchange market can use the index for launching a suite of derivative contracts. (6 marks)

- (b) Explain, with reference to hedging activity, why it would be reasonable to expect that derivatives based on a commodities index constructed using a broad range of basic commodities would be more liquid at longer maturities than derivatives based on individual commodities. (4 marks)

- (c) Briefly explain the following terms:

- (i) Forward contract. (2 marks)
- (ii) Forward price. (2 marks)
- (iii) Forward interest rate. (2 marks)

- (d) An investor in the oil industry has noted that arbitrage opportunities exist between spot prices and future prices over long periods.

Explain to the investor the possible reasons for this trend.

(4 marks)  
(Total: 20 marks)

#### QUESTION THREE

- (a) Explain four similarities between interest rate futures and currency futures. (8 marks)
- (b) Briefly explain how currency options can be applied in hedging a foreign exchange exposure. (4 marks)
- (c) XYZ Limited intends to invest in a three year debenture stock whose face value is Sh.1,000 payable on maturity. The debenture stock's current value is Sh.1,050. The coupon rate is 10% while the yield to maturity is 8.0%. Interest is payable semi annually. The company plans to buy the debenture stock in six months time. In the same market, a one year treasury bond has a yield to maturity of 8.80% and pays interest semi-annually.

**Required:**

- (i) The equivalent rate of the yield to maturity of the treasury bond continuously compounded. (4 marks)  
(Note:  $\ln 1.044 = 0.04305$ ).
- (ii) The best six-months price for the debenture stock which XYZ Limited should quote when applying for a forward rate agreement (FRA). (4 marks)
- (Total: 20 marks)

#### QUESTION FOUR

- (a) (i) Briefly explain the importance of managing interest rate risk. (4 marks)
- (ii) Outline four approaches to the management of interest rate risk. (4 marks)
- (b) Assume that on 30 July 2010, interest rate futures were quoted as follows:

	Sh.
September 2010	92.50
December 2010	92.70
March 2011	92.80

Each futures contract has a notional value of Sh.500,000. Pinto Traders intends to raise a Sh.1,000,000 floating rate loan at the end of December 2010 with a three months maturity period.

The firm is concerned that interest rates may increase.

**Required:**

Suggest an appropriate hedging strategy to reduce interest rate risk.

- (c) Identify and briefly explain five limitations of the Black-Scholes-Merton model for valuation of options. (10 marks)
- (Total: 20 marks)

#### QUESTION FIVE

- (a) Describe the role of futures contracts in financial markets. (8 marks)
- (b) Citing relevant examples, explain the following methods of mitigating credit risk associated with derivatives:
- (i) Netting. (4 marks)
- (ii) Collateralisation. (5 marks)
- (Total: 20 marks)

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**VALUATION AND ANALYSIS OF DERIVATIVES**  
**CSIA PART III SECTION 6**

**TUESDAY: 8 June 2010.**

**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) (i) Briefly explain the two main types of derivative markets. (4 marks)
- (ii) Outline two ways of assessing the performance of a derivative market. (4 marks)
- (b) The presence of derivative markets and more recently their extraordinary growth, raises some important concerns about vulnerability of the financial sector and the economy at large.
- Explore three positive and three negative roles of derivative markets in an economy. (12 marks)

**(Total: 20 marks)**

**QUESTION TWO**

- (a) The table below shows the current price of zero coupon bonds (strips) and their yields (with simple-return annual compounding) in US dollars (USD).

Maturity in years	Yield on zero coupon bonds	Implied forward rate	Zero price
1	2.40 %	2.40%	0.97656
2	2.80%	3.202%	0.94627
3	3.20%	4.005%	0.90983
4	3.50%	4.405%	0.87144

The implied forward rates are for one year periods up to the time of maturity of the bonds.

Assume that three years ago, a company entered into an interest rate swap, receiving 4% per annum fixed (with annual compounding) and paying 12 months LIBOR on a notional of 100 million USD. Currently, the swap has a remaining life of 4 years.

**Additional information:**

- All interest rates are risk free and there is no credit risk.
- The one-year forward rate is equal to the 12-months forward LIBOR.

**Required:**

- (i) The current value of the two bonds involved in the swap above. (4 marks)
- (ii) The value of the interest rate swap. (2 marks)
- (iii) Show that the value of the swap remains unchanged when it is broken down into a portfolio of forward contracts. (4 marks)
- (iv) Given the conditions shown in the table above, determine the current swap rate for a four-year generic interest rate swap. (4 marks)
- (b) With reference to the operations of derivative markets, outline the distinction between:
- (i) Speculation and hedging. (2 marks)
- (ii) Long hedges and short hedges. (2 marks)
- (iii) Commodity futures and financial futures. (2 marks)

**(Total: 20 marks)**

**QUESTION THREE**

- (a) Briefly explain the following terms as used in the derivative market:

- (i) Equity options. (3 marks)
- (ii) Stock index options. (3 marks)

(iii) Foreign currency options. (3 marks)

(iv) European options. (3 marks)

- (b) Consider the following securities which accrue interest annually.

Security	Coupon	Maturity	Yield	Duration
A	8%	10 years	10%	7.0439
B	10%	15 years	8%	8.8569

**Additional information:**

- The securities are currently trading at 87.71 for Security A and 117.12 for Security B for a par value of Sh.100.
- The yield beta applicable to the two securities is 1.

**Required:**

The duration-based hedge ratio for the two securities. (5 marks)

- (c) The following price quotes were in existence as at mid-February 2010 for treasury bond and treasury note futures maturing in June 2010:

Contract	Settlement price	Implied yield
20-year, 8% treasury bond	103-02	7.70%
10-year, 8% treasury note	104-02	7.42%

The settlement price is quoted for each Sh.100 par value of the security.

Suppose an investor holding Sh.100,000 decides to:

- Go long in one treasury bond futures contract, and
- Go short in one treasury note futures contract.

**Required:**

Determine the profit (or loss) realised by the investor if interest rates in June 2010 increase to 8%. (3 marks)

**(Total: 20 marks)**

**QUESTION FOUR**

Derivative markets are non-existent in many developing countries. Even in the few developing countries where they exist, their growth has been hampered by many challenges.

Discuss five factors that have inhibited the growth of derivative markets in developing countries. (20 marks)

**QUESTION FIVE**

- (a) Briefly explain the term "stock index arbitrage" in the context of derivatives. (4 marks)
- (b) Assume that one "share" of the Standard and Poor's (S & P) 500 index can be purchased for 1,250 US dollars and that the dividend yield and risk-free rate over the holding period are 1.5 per cent and 2.5 per cent respectively.

An investor decides to construct a short hedge position by:

- Purchasing the index at 1,250.00 US dollars, and
- Shorting the futures at 1,262.50 US dollars.

The investor holds this position to expiration.

**Required:**

The gain (or loss) realised by the investor if the S & P 500 index on expiration stands at:

- (i) 1,220. (2 marks)
- (ii) 1,240. (2 marks)
- (iii) 1,260. (2 marks)
- (iv) 1,280. (2 marks)
- (v) 1,300. Comment on the relationship depicted between the gain (or loss) realised and the S & P 500 index. (4 marks)

- (c) Suppose that in (b) above, the actual contract price on 6-month S & P futures was 1,265.50 US dollars and that a stock index arbitrageur had undertaken the following:

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# VALUATION AND ANALYSIS OF DERIVATIVES

FRIDAY: 4 December 2009.

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) Assume the current Nikkei average index is 16,000 points and that Nikkei average futures and options (European type) which are expected to mature in three months time are currently trading in the market.

### Additional information:

- The futures price is equivalent to the non-arbitrage price.
- The call and put option prices are given in the table below:

Prices are quoted in Japanese Yen (JPY)

	Strike price	Option price	Delta
	JPY	JPY	
Call	18,000	109.820	0.141
	17,000	297.563	0.306
	16,000	577.145	0.540
Put	16,000	300.000	-0.460
	15,000	222.369	-0.228
	14,000	56.488	-0.076

Assume the short term interest rate will remain constant at 2% per annum.

Ignore dividends and trading costs.

### Required:

- The current Nikkei average futures price. (3 marks)
  - Using the put/call parity equation, calculate the present price (p) of the Nikkei average put option with a strike price of 16,000 JPY. (3 marks)
- (b) A trader in the international market needs to hedge the risk on purchase of Japanese electronic items. The invoice received by the trader is due for payment in 80 days. A forward contract and a 90-day futures contract are available in the market.

### Required:

Assuming no mispricing exists in the market, advise the trader on whether to hedge using a forward contract or futures contract. Support your advice with relevant arguments. (4 marks)

- (c) Identify and briefly explain five items that should be specified in a futures contract. (10 marks)
- (Total: 20 marks)

## QUESTION TWO

- (a) Describe four ways of terminating a swap contract before the agreed maturity date. (8 marks)
- (b) A plain vanilla interest rate swap was recently advertised in an international journal. The advertisement contained the following details:

Period	LIBOR (%)
Current	4.0
90 days	4.5
180 days	5.0
270 days	5.5
360 days	6.0

An investor, A, intends to enter into a Euro 1,000,000 quarterly pay plain vanilla interest rate swap as the fixed rate payer.

Another investor, B, who is a floating rate payee, is willing to pay 90-day LIBOR plus 1 per cent margin.

Assume a 360-day year.

### Required:

Assuming investor A enters into a swap contract with investor B, determine the amount that investor A will pay or receive, if any, in euros:

- 90 days from today. (3 marks)
  - 270 days from today. (3 marks)
  - 360 days from today. (3 marks)
- (c) Citing examples, distinguish between exchange traded and over-the-counter derivatives. (3 marks)
- (Total: 20 marks)

## QUESTION THREE

- (a) A 3-month forward contract exists on a bond that does not offer any coupon. The face value of the bond is Sh.1,000,000 but is currently trading at Sh.500,000. From available market data, the risk-free annual interest rate is 6 per cent.

### Required:

- The price of the forward contract under the no-arbitrage principle. (3 marks)
  - Assume that, after exactly two months, the spot price on the bond is Sh.515,000, while the risk-free rate remains unchanged. Determine the value of the long and short positions in the forward contract. (5 marks)
- (b) (i) Explain the term "arbitrage" and its role in promoting market efficiency. (5 marks)
- (ii) Mombasa Exporters Ltd.'s shares are currently trading on the local stock exchange at Sh.300 each. In exactly 15 days time, the company expects to pay a dividend of Sh.4 per share. The company directors have also approved another Sh.4 dividend per share to be paid in 105 days time. Forecast data indicate that the yield curve is flat and the risk free rate is 5 per cent.
- Assume a 365-day year.

### Required:

The no-arbitrage price for a 120-day future on Mombasa Exporters Ltd.'s share. (7 marks)

(Total: 20 marks)

## QUESTION FOUR

- (a) You are a financial analyst with Hakim Investment Consultants. Your senior advised you that interest rate derivatives are known to derive their value from some cash market instrument or reference interest rate.
- Your senior has now presented you with the following information on an issue that is deliverable for a treasury bond futures contract.

	Futures contract	Deliverable issue
Price	Sh.102,000	Sh.96,000
Days to future delivery date	114 days	
Days remaining before interim coupon		79 days
Accrued interest paid		Sh.3,221.90
Coupon interest rate		8%
Interim coupon		Sh.4,000
Days between interim coupon payment receipt and the actual delivery date of future		35 days
Conversion factor		0.9305
Accrued interest received at futures settlement date		Sh.1,731.50

### Required:

The implied repo rate for the above issue assuming the 35-day term-repo rate is 5%.

Assume a 360-day year. (10 marks)

- (b) Explain the role of derivatives in the global financial market. (10 marks)
- (Total: 20 marks)

## QUESTION FIVE

- (a) Consider futures and European options on the stock market index (SMI) of a given country. The stock index is currently at 1,000. 3-month futures and 3-month options on this index with strike prices of Sh.900, Sh.1,000 and Sh.1,100 are trading at exactly their theoretical prices.