



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:

- (i) Maximum loss from a bull spread using August puts with strike prices of Sh.30 and Sh.25. (4 marks)
- (ii) 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**

- (a) (i) Evaluate four factors that could determine the value of option prices. (4 marks)
- (ii) 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)

- (b) 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)

- (c) 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)

- (d) 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.

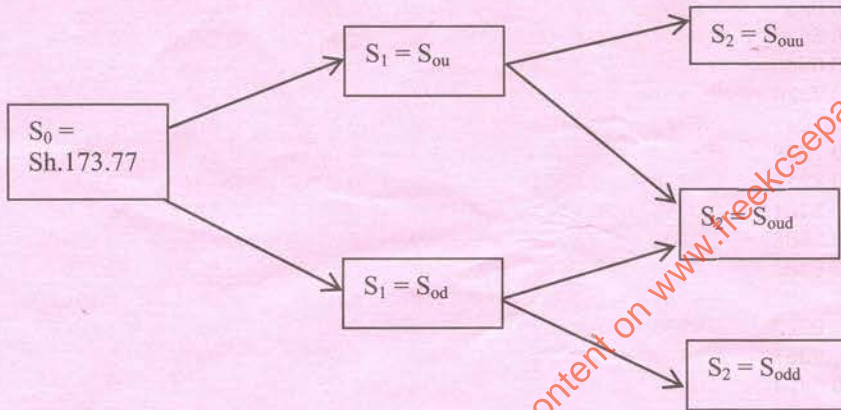
**Required:**

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.

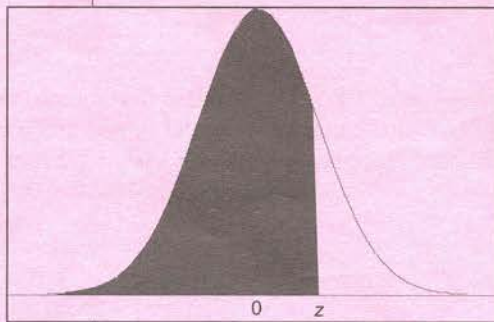
Assume the year has 365 days.

(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  $z$ .

<b>z</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
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									