kasneb

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 45days.   (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 ma.

     (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)
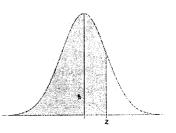
(e   Examine three sources of gains and losses from delta hedging for a market-maker.   (3 marks)
(Total: 20 marks)

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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Standard Normal Cumulative Probability Table

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