



DIPLOMA SUMMER 2008 EXAMINATION

FINANCIAL DERIVATIVES

DATE OF EXAM	Thursday 26 June 2008
3 HOURS	2.00 pm – 5.00 pm
RUBRIC	SECTION A - <i>ALL</i> questions in this section are to be answered
	SECTION B } Answer FOUR questions in total from Sections B and C, SECTION C } at least TWO questions from Section B and ONE from } Section C. The remaining question may be from EITHER } Section.

Candidates are reminded that no marks will be awarded for illegible work

NOTES TO CANDIDATES

1. Please insert your Candidate Number on the cover of your Answer Book. *Do not insert your name.*
2. Show *all* workings in your Answer Book.
3. Candidates may attempt the sections in any order. Please indicate clearly in your Answer Book which questions you are answering.
4. Please insert in the box provided on the cover of your Answer Book the numbers of the questions you have attempted in the order in which they appear in the Answer Book.
5. You may use the calculator provided or one approved by the Securities & Investment Institute.
6. You must hand your Answer Book to an invigilator before you leave the Examination Hall. *Failure to do so will result in disqualification.*
7. The decision of the panel is final and no correspondence will be entered into concerning the grade awarded.
8. Once submitted, the examination scripts become the property of the Securities & Investment Institute and will not be returned to candidates.

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PLEASE TURN OVER WHEN INSTRUCTED

Answer ALL questions in this section

1 You observe the following discount function for Euros:

6-Month	0.9828
1-Year	0.9639
18-Month	0.9446
2-Year	0.9256

Estimate the cash flow you would expect to pay (negative) or receive (positive) in 12 months' time on a 1-year/18-month Forward Rate Agreement where you have fixed the borrowing rate on €100,000,000 at 3.50% *(4 marks)*

2 You own an equity portfolio valued at £50 million which has a beta of 1.15 with respect to the market index, and a non-systematic or specific risk of 12% per annum. If the overall market risk or volatility is estimated at 20% per annum, what is the Value at Risk (VAR) for the portfolio over a two week time horizon at a 95% one-sided confidence limit? *(4 marks)*

3 You own an Over The Counter index put option with a strike of 6000 and an index point value of £250. The option has a delta of -0.35 and a gamma of 0.002. What sterling loss would you expect on the option if the index rises by 50 index points from its current level of 6150. *(4 marks)*

4 You own a six month 102.50 strike call option on a non-dividend paying stock with a price of 100. Assume the interest rate curve is flat at an annual rate of 3.5% continuously compounded, and the annual volatility of the stock is 25%. Use a two step binomial model to:

a) Calculate the price of the option. *(2 marks)*

b) Calculate the delta of the option. *(2 marks)*

5 What volatility would you use to price the following two asset options if the volatility of the first asset is 25% per annum, the volatility of the second asset is 30% per annum, and the correlation between the returns on the two assets is 0.40%.

a) An option on an equally weighted basket of the two assets. *(2 marks)*

b) An option to exchange one asset for the other. *(2 marks)*

SECTION B

Answer **FOUR** questions in total from Sections B and C, **TWO** questions from Section B and **ONE** from Section C. The remaining question may be from **EITHER** Section. All questions in these sections carry **20** marks.

6 You are provided with the following information for a stock index:

LEVEL	DIVIDEND YIELD	ANNUAL VOLATILITY
1000	2.50%	20%

The three month interest rate is currently 4.0%. Assume the dividend yield and interest rate are provided as continuously compounded rates.

- Determine the probability of exercise in a risk neutral framework for a three-month maturity 1050 strike call option. *(4 marks)*
- Determine the price and delta of such an option. *(6 marks)*
- Explain the relative interest rate and yield sensitivity of the call option. *(4 marks)*
- Determine the price at which a 1050 strike European put option must trade to avoid arbitrage. Explain why this arbitrage relationship may not hold for an American put. *(6 marks)*

7 You own the following equity portfolio:

<u>STOCK</u>	<u>NUMBER OF SHARES</u>	<u>SHARE PRICE</u>	<u>MARKET VALUE</u>	<u>BETA</u>	<u>SPECIFIC RISK</u>	<u>TOTAL RISK</u>
ABC	200,000	60	12,000,000	1.10	10%	24.17%
DEF	150,000	80	12,000,000	0.80	12%	20.00%
XYZ	300,000	90	27,000,000	1.20	11%	26.40%

The annual market risk or volatility is estimated at 20% per annum. The current date is August 15 and the stock index is currently trading at 1000. The September stock index futures contract (delivery date September 19) is trading at 1005. The point value of the futures contract is 250 per index point.

- Calculate the number of futures contracts required for a full hedge of the equity portfolio through to the delivery date of September 19. *(6 marks)*
- What locked-in value of the portfolio do you anticipate at the delivery date? *(4 marks)*
- Estimate the Value at Risk (VAR) of the unhedged equity portfolio at a 95% confidence interval over the period August 15 – September 19. *(5 marks)*

d) At the delivery date of September 19, the following prices are observed:

STOCK INDEX	950
ABC	56
DEF	78
XYZ	83

Analyse the results of the futures hedge, and explain the differences between the anticipated and the actual hedge performance. *(5 marks)*

8 You are an investment bank arranging a range note issue for an issuer. The issuer's funding target is LIBOR -20 Basis Points, and you wish to earn 20 Basis Points in upfront fees on the transaction. You have identified an investor who would be happy to buy a one year note which pays a suitable additional margin over sterling LIBOR if the FTSE-100 index remains within a 5500 - 6500 range around its current level of 6000, and nothing if the index moves outside that range. You estimate the annual dividend yield on the FTSE-100 index as 2% and the annual volatility of the index as 17.5%. The current one-year LIBOR is 5.00%. Assume all the rates and yields are provided on a continuously compounded basis.

a) Analyse how you would construct such a note and what margin over LIBOR you could provide to the investor. *(12 marks)*

b) Discuss the risks for the investment bank of hedging such a product through to maturity. *(8 marks)*

- 9 You are requested by a client to quote a bid-ask spread for a zero cost collar on the Sterling/US dollar exchange rate. The required maturity is that of the June 2008 options expiry on the Chicago Mercantile Exchange. The higher FX rate will be USD 1.98/£ STERLING, and you observe option prices trading as on the attached Bloomberg screen. The size of the requested transaction is £25,000,000.
- If you, as a broker, require a profit margin of 0.10% of the underlying amount, determine the lowest FX rate you would be able to quote the client. (10 marks)
 - What combination of the exchange traded options would you use to hedge the resultant exposure? (6 marks)
 - Comment on the risk management and hedging issues involved in managing this exposure. (4 marks)

<HELP> for explanation. CurncyOHT
 Screen Printed
 17:46 DISPLAY: C-chg/%chg, D-delta/volat
 Mon 5/12

OPTION HORIZON ANALYSIS
 JUN OPTIONS ON BP CURRENCY FUT Jun08 Delayed Prices
BPM8 MARKET IS OPEN

TODAY								7 DAYS LATER							
195.52								195.52 unch							
CALLS				PUTS				CALLS				PUTS			
STRIKE	Prc	Del	I.Vol	Prc	Del	I.Vol		Prc	Chg	%Chg	Prc	Chg	%Chg		
192.0	4.18e	.77	9.58	.68	.23	9.68		3.97	-.21	-5%	.46	-.22	-32%		
193.0	3.44e	.70	9.51	.92e	.30	9.49		3.19	-.25	-7%	.67	-.25	-27%		
194.0	2.79	.63	9.54	1.23	.37	9.32		2.51	-.28	-10%	.96	-.27	-22%		
195.0	2.19	.55	9.43	1.62	.45	9.18		1.90	-.29	-13%	1.34	-.28	-17%		
196.0	1.62e	.46	9.06	2.09	.54	9.02		1.34	-.28	-17%	1.81	-.28	-13%		
197.0	1.23	.38	9.17	2.65	.62	8.87		.96	-.27	-22%	2.39	-.26	-10%		
198.0	.89	.30	9.13	3.30e	.70	8.76		.65	-.24	-27%	3.07	-.23	-7%		
199.0	.62	.23	9.07	4.05	.77	8.77		.42	-.20	-32%	3.86	-.19	-5%		

Mon 5/12/08 (25days Expr) 1.90 Fin | Mon 5/19/08 (18days Expr) 1.90 Fin

OPTION PRICING: T- TICKER price S - SAME volatility
 M- trade MATCH volatility 12.5% (or any other volat.)

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
 6613-237-0 12-May-2008 17:47:03

10 You are provided with the following set of interest rate information:

	<u>USD</u>			<u>EURO</u>		
	<u>PAR SWAP RATE</u>	<u>SPOT RATE</u>	<u>DISCOUNT FACTOR</u>	<u>PAR SWAP RATE</u>	<u>SPOT RATE</u>	<u>DISCOUNT FACTOR</u>
1-YEAR	2.9000	2.9000	0.971817	3.5000	3.5000	0.966184
2-YEAR	2.9985	3.0000	0.942596	3.5983	3.6000	0.931709
3-YEAR	3.1201	3.1250	0.911818	3.7433	3.7500	0.895438
4-YEAR	3.2402	3.2500	0.879913	3.8627	3.8750	0.858926
5-YEAR	3.4746	3.5000	0.841973	3.9800	4.0000	0.821927

The current Sterling/US dollar exchange rate is USD 1.95/£.

a) You observe that you can buy €50 million par value of a 4.00% coupon Euro denominated bond maturing in five years' time at a price of 99.50. What spread over USD LIBOR do you think you could achieve if you implemented an asset swap with the bond to create a synthetic US dollar FRN paying annual interest?

(12 marks)

b) Show how you would hedge out the cash flow risks involved in the transaction if you purchased the bond and sold the synthetic FRN to a customer.

(8 marks)

11 Give your considered assessment of the following statements concerning derivatives and derivatives markets.

a) In virtually all circumstances, the decision to assume interest rates are normally or lognormally distributed makes no significant difference to the pricing of interest rate swaptions.

(7 marks)

b) Volatility skews and smiles in equity index derivatives markets contain no information about price and volatility correlation structures.

(7 marks)

c) Asset swap spreads and credit default swap prices ought to be entirely consistent.

(6 marks)

SECTION C

All questions carry 20 marks

- 12 The development of synthetic as opposed to conventional Collateralised Debt Obligations (CDOs) has contributed significantly to the credit crisis of 2007-2008. Discuss.
- 13 Many market practitioners suggest that asset returns are better fitted by a jump-diffusion process than the traditional diffusion process assumed by models such as Black-Scholes and the Binomial. Analyse the implications of this statement, if valid, for derivatives pricing and risk management.
- 14 A wind farm in Spain approaches you (a major investment bank) for financing of a major expansion. It would like its interest payments to map into its energy production. It informs you that little electricity is produced if the wind speed falls below 15-20 kilometres per hour, and it also has to shut down the generators if the wind speed goes above 105 kilometres per hour. Write a report suggesting new and innovative financing approaches for this customer.
- 15 Discuss the potential use of derivatives to cover the risk exposure of major pension funds to the increasing life expectancy of their members.

TABLE FOR $N(x)$ when $x \leq 0$

This table shows values of $N(x)$ for $x \leq 0$. The table should be used with interpolation. For example

$$\begin{aligned} N(-0.1234) &= N(-0.12) - 0.34[N(-0.12) - N(-0.13)] \\ &= 0.4522 - 0.34 \times (0.4522 - 0.4483) \\ &= 0.4509 \end{aligned}$$

x	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-3.0	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
-3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
-3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
-3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
-3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TABLE FOR $N(x)$ when $x \geq 0$

This table shows values of $N(x)$ for $x \geq 0$. The table should be used with interpolation. For example

$$\begin{aligned} N(0.6278) &= N(0.62) + 0.78[N(0.63) - N(0.62)] \\ &= 0.7324 + 0.78 \times (0.7357 - 0.7324) \\ &= 0.7350 \end{aligned}$$

x	.00	.01	.02	.03	.04	.05	.06	.07	.08	.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	0.9986	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	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000