Professional Level – Options Module

Advanced Financial Management

Thursday 10 December 2009

Paper P4

Time allowed
Reading and planning: 15 minutes
Writing: 3 hours

This paper is divided into two sections:

Section A – BOTH questions are compulsory and MUST be attempted

Section B – TWO questions ONLY to be attempted
Formulae and tables are on pages 9–13.

**Do NOT open this paper until instructed by the supervisor.
During reading and planning time only the question paper may
be annotated. You must NOT write in your answer booklet until
instructed by the supervisor.
This question paper must not be removed from the examination hall.**

ACCA

The Association of Chartered Certified Accountants

Section A – BOTH questions are compulsory and MUST be attempted

1   Kodiak Company is a small software design business established four years ago. The company is owned by three directors who have relied upon external accounting services in the past. The company has grown quickly and the directors have appointed you as a financial consultant to advise on the value of the business under their ownership.

The directors have limited liability and the bank loan is secured against the general assets of the business. The directors have no outstanding guarantees on the company's debt.

The company's latest income statement and the extracted balances from the latest statement of financial position are as follows:

Income Statement	$'000	Financial Position	$000
Revenue	5,000	Opening non-current assets	1,200
Cost of Sales	3,000	Additions	66
Gross profit	2,000	Non-current assets (gross)	1,266
Other operating costs	1,877	Accumulated depreciation	367
Operating profit	123	Net book value	899
Interest on loan	74	Net current assets	270
Profit before tax	49	Loan	(990)
Income tax expense	15	Net Assets Employed	179
Profit for the period	34		

During the current year:

(1) Depreciation is charged at 10% per annum on the year end non-current asset balance before accumulated depreciation, and is included in other operating costs in the income statement.

(2) The investment in net working capital is expected to increase in line with the growth in gross profit.

(3) Other operating costs consisted of:

	$000
Variable component at 15% of sales	750
Fixed costs	1,000
Depreciation on non-current assets	127

(4) Revenue and variable costs are projected to grow at 9% per annum and fixed costs are projected to grow at 6% per annum.

(5) The company pays interest on its outstanding loan of 7·5% per annum and incurs tax on its profits at 30%, payable in the following year. The company does not pay dividends.

(6) The net current assets reported in the statement of financial position contain $50,000 of cash.

One of your first tasks is to prepare for the directors a forward cash flow projection for three years and to value the firm on the basis of its expected free cash flow to equity. In discussion with them you note the following:

–   The company will not dispose of any of its non-current assets but will increase its investment in **new** non-current assets by 20% per annum. The company's depreciation policy matches the currently available tax write off for capital allowances. This straight-line write off policy is not likely to change.

–   The directors will not take a dividend for the next three years but will then review the position taking into account the company's sustainable cash flow at that time.

–   The level of the loan will be maintained at $990,000 and, on the basis of the forward yield curve, interest rates are not expected to change.

–   The directors have set a target rate of return on their equity of 10% per annum which they believe fairly represents the opportunity cost of their invested funds.

Required:

(a) Prepare a three-year cash flow forecast for the business on the basis described above highlighting the free cash flow to equity in each year. (12 marks)

(b) Estimate the value of the business based upon the expected free cash flow to equity and a terminal value based upon a sustainable growth rate of 3% per annum thereafter. (6 marks)

(c) Advise the directors on the assumptions and the uncertainties within your valuation. (6 marks)

(d) With reference to option pricing theory, advise the directors how limited liability may give a different value to the business from the value estimated in part (b) above. (4 marks)

(28 marks)

2   Anchorage Retail Company is a large high street and on-line retailer that has lost its position as the premier quality clothes, household goods and food chain in the European market. Five years previously there had been speculation that the company would be a takeover target for any one of a number of private equity firms. However, a newly appointed and flamboyant Chief Executive Officer, John Bear, initiated a major capital reconstruction and a highly aggressive turnaround strategy.

The reaction to that turnaround strategy was an improvement in the company's share price from $3 to $7 per share over the subsequent three years. The private equity firms who had been interested in acquiring the company were deterred for two principal reasons. First John Bear had a reputation for his aggressive style and his history of defending his companies against takeover. Second the share price of Anchorage had reached a record high.

In recent months a belief in the investment community had become widespread that the revival of the company's performance had more to do with the reorganisation of the firm's capital than the success of John Bear's turnaround strategy. John Bear insisted, however, that the improvements in the reported 'bottom line' reflected a sustainable improvement in the performance of the business. However, the recent recession in the European retail market following the 'credit crunch' led to a sharp reduction in Anchorage's share price reinforced by concerns in the financial markets that John Bear has become too dominant in the board of the company.

The most recent accounts for Anchorage Retail, in summary form, are as follows:

Anchorage Retail Company

	2009 $m	2008 $m		2009 $m
Income statement			Summary cash flow statement	
Sales Turnover	9,000	8,500		
Cost of Sales	5,500	5,250	Operating cash flow	1,610
Gross Profit	3,500	3,250	less interest	(110)
less other operating costs	2,250	2,220	less taxation	(270)
Operating profit	1,250	1,030	Free cash flow before reinvestment	1,230
Finance Costs	80	110	Dividend paid	(270)
Profit before tax	1,170	920	CAPEX	(740)
Income tax expense (at 30%)	310	270	Financing	(70)
Profit for the period	860	650	Net cash flow	150

Statement of financial position	2009 $m	2008 $m
Assets		
Non-current assets	4,980	4,540
Current assets	1,220	850
Total assets	6,200	5,390
Equity and Liabilities		
Ordinary share capital (25c)	400	425
Share premium	230	200
Capital redemption reserve	2,300	2,300
Other reserves	(6,540)	(6,500)
Retained earnings	5,990	5,400
Dividends payable	(350)	(270)
Total equity	2,030	1,555
Non-current liabilities	1,900	1,865
Current liabilities	2,270	1,970
Total equity and liabilities	6,200	5,390

The management of Polar Finance, a large private equity investment fund, has begun a review following the sale of a substantial part of its investment portfolio. It is now considering Anchorage as a potential target for acquisition. They have contacted you and asked if you would provide a brief report on the financial performance of Anchorage Retail and give an independent view on a bid the company is considering for the business. The suggested bid would be in the form of a cash offer of $3·20 a share which would represent a 60¢ premium on the current share price. Reviewing the fund's existing business portfolio prior to acquisition you estimate that its asset beta is 0·285. Polar Finance has equity funds under management of $1,125 million and a market based gearing ratio (debt as a proportion of total capital employed) of 0·85. This acquisition would be financed from additional cash resources and by additional borrowing of $2·5 billion. It is expected that Anchorage's proportion of the total post-acquisition cash flows will be 20%. Polar Finance does not pay tax on its income.

During your investigations you discover the following:

1. The equity beta for Anchorage is 0·75. The current risk free rate is 5%. In order to estimate the rate of return on the market using the dividend growth model you note that the current dividend yield on a broadly based market index is 3·1% and the growth in GDP is 4% nominal. The growth of the firms in the index is fairly represented by growth in GDP.

2. Anchorage has a gearing ratio based upon market capitalisation of 24%. You estimate that its current cost of debt capital is 6·2%. You may assume that Anchorage's cost of finance has been constant over the last twelve months.

You may use year end financial position values when calculating performance ratios.

Required:

Prepare a report for Polar Finance:

(a) Outlining the principal risks that Polar Finance should consider when assessing an acquisition of this size.

(6 marks)

(b) Summarising the performance of Anchorage in 2009 compared with 2008 on the basis of the EVA® for each year and using two other ratios you consider appropriate. (12 marks)

(c) Estimating the impact of this acquisition upon the required rate of return of equity investors in Polar Finance.

(6 marks)

(d) Evaluating the argument that this company may have been systematically undervalued by the market and therefore a suitable target for acquisition. (4 marks)

Professional marks will be awarded for the appropriateness of the format and presentation of the report and the effectiveness with which its advice is communicated. (4 marks)

(32 marks)

Section B – TWO questions ONLY to be attempted

3 Alaska Salvage is in discussion with potential lenders about financing an ambitious five-year project searching for lost gold in the central Atlantic. The company has had great success in the past with its various salvage operations and is now quoted on the London Alternative Investment Market. The company is currently financed by 120,000 equity shares trading at $85 per share. It needs to borrow $1·6 million and is concerned about the level of the fixed rates being suggested by the lenders. After lengthy discussions the lenders are prepared to offer finance against a mezzanine issue of fixed rate five-year notes with warrants attached. Each $10,000 note, repayable at par, would carry a warrant for 100 equity shares at an exercise price of $90 per share. The estimated volatility of the returns on the company's equity is 20% and the risk free rate of interest is 5%. The company does not pay dividends to its equity investors.

You may assume that the issue of these loan notes will not influence the current value of the firm's equity. The issue will be made at par.

Required:

(a) Estimate, using Black-Scholes Option Pricing Model as appropriate, the current value of each warrant to the lender noting the assumptions that you have made in your valuation. (10 marks)

(b) Estimate the coupon rate that would be required by the lenders if they wanted a 13% rate of return on their investment. (4 marks)

(c) Discuss the advantages and disadvantages of issuing mezzanine debt in the situation outlined in the case. (6 marks)

(20 marks)

4 You are the Chief Financial Officer of Moose Co. Moose Co is a manufacturer of cleaning equipment and has an international market for its products. Your company places a strong emphasis on innovation and design with patent protection across all its product range.

The company has two principal manufacturing centres, one in Europe which has been reduced in size in recent years because of high labour costs and the other in South East Asia. However, Moose Co's development has relied upon ready access to the debt market both in Europe and in South East Asia and the company is planning significant expansion with a new manufacturing and distribution centre in South America. Your company is highly profitable with strong cash flows although in the last two quarters there has been a downturn in sales in all markets as the global recession has begun to take effect.

Since August 2007, credit conditions have deteriorated across all of the major economies as banks have curtailed their lending following the down rating of US asset-backed securities. In 2008 and 2009 many banks recorded significant multibillion dollar losses as they attempted to sell off what had become known as 'toxic debt', leading to a further collapse in their value. In response many banks also attempted to repair their financial position by rights and other equity issues.

The founder and executive chairman of the company, Alan Bison, is planning a round of meetings with a number of investment banks in leading financial centres around the world to explore raising a $350 million dollar loan for the new development. It has already been suggested that a loan of this size would need to be syndicated or alternatively raised through a bond issue.

In preparation for those meetings he has asked you to provide him with some briefing notes.

Required:

(a) Given conditions in the global debt market as described above, advise on the likely factors banks will consider in offering a loan of this size. (7 marks)

(b) Assess the relative advantages of loan syndication versus a bond issue to Moose Co. (7 marks)

(c) Assess the relative advantages and disadvantages of entering into a capital investment of this scale at this stage of the global economic cycle. (6 marks)

(20 marks)

5 To finance capital investment in its domestic market, the Katmai Company raised $150 million through the issue of 12-year floating rate notes at 120 basis points over LIBOR, interest payable at six month intervals. Following a review of the current yield curve, the company's Chief Financial Officer has become concerned about the potential impact of rising LIBOR on the firm's future cash flows. The loan now has 10 years to maturity. The CFO asks you, his deputy, to examine the choices that are now available to the firm and to recommend the best course of action. She comments that a swap is an obvious choice but that she would appreciate a briefing on the advantages and disadvantages of the alternative approaches to managing the company's interest rate risk and an estimate of the six monthly Value at Risk (VaR) if nothing is done. As part of your investigation you note that 10-year swap rates are quoted at 5·25–5·40. In estimating the VaR you note that the firm has a policy of 95% confidence level on its exposure to non-core risk and that the annual volatility of LIBOR is currently 150 basis points.

Required:

(a) Evaluate the alternative choices the company has for managing its interest rate exposure and recommend, with justification, the course of action the company should follow. (9 marks)

(b) Estimate the six-monthly interest rate and the effective annual rate payable if a vanilla interest rate swap is agreed. (5 marks)

(c) Estimate the six monthly Value at Risk on the interest rate exposure associated with this borrowing and comment upon the interpretation of the result. (6 marks)

(20 marks)

Formulae

Modigliani and Miller Proposition 2 (with tax)

$$k_e = k_e^i + (1 - T)(k_e^i - k_d)\frac{V_d}{V_e}$$

Two asset portfolio

$$s_p = \sqrt{w_a^2 s_a^2 + w_b^2 s_b^2 + 2w_a w_b r_{ab} s_a s_b}$$

The Capital Asset Pricing Model

$$E(r_i) = R_f + \beta_i(E(r_m) - R_f)$$

The asset beta formula

$$\beta_a = \left[\frac{V_e}{(V_e + V_d(1-T))}\beta_e\right] + \left[\frac{V_d(1-T)}{(V_e + V_d(1-T))}\beta_d\right]$$

The Growth Model

$$P_o = \frac{D_o(1+g)}{(r_e - g)}$$

Gordon's growth approximation

$$g = br_e$$

The weighted average cost of capital

$$WACC = \left[\frac{V_e}{V_e + V_d}\right]k_e + \left[\frac{V_d}{V_e + V_d}\right]k_d(1-T)$$

The Fisher formula

$$(1 + i) = (1 + r)(1 + h)$$

Purchasing power parity and interest rate parity

$$S_1 = S_0 \times \frac{(1 + h_c)}{(1 + h_b)} \qquad\qquad F_0 = S_0 \times \frac{(1 + i_c)}{(1 + i_b)}$$

[P.T.O.

The Put Call Parity relationship

$$p = c - P_a + P_e e^{-rt}$$

Modified Internal Rate of Return

$$MIRR = \left[\frac{PV_R}{PV_I}\right]^{\frac{1}{n}} \left(1 + r_e\right) - 1$$

The Black-Scholes option pricing model	The FOREX modified Black-Scholes option pricing model
$c = P_a N(d_1) - P_e N(d_2)e^{-rt}$ Where: $d_1 = \dfrac{\ln(P_a / P_e) + (r + 0.5s^2)t}{s\sqrt{t}}$ $d_2 = d_1 - s\sqrt{t}$	$c = e^{-rt}\left[F_0 N(d_1) - XN(d_2)\right]$ Or $p = e^{-rt}\left[XN(-d_2) - F_0 N(-d_1)\right]$ Where: $d_1 = \dfrac{\ln(F_0 / X) + s^2 T/2}{s\sqrt{T}}$ and $d_2 = d_1 - s\sqrt{T}$

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Present Value Table

Present value of 1 i.e. $(1 + r)^{-n}$

Where   r = discount rate

          n = number of periods until payment

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	0·980	0·961	0·943	0·925	0·907	0·890	0·873	0·857	0·842	0·826	2
3	0·971	0·942	0·915	0·889	0·864	0·840	0·816	0·794	0·772	0·751	3
4	0·961	0·924	0·888	0·855	0·823	0·792	0·763	0·735	0·708	0·683	4
5	0·951	0·906	0·863	0·822	0·784	0·747	0·713	0·681	0·650	0·621	5
6	0·942	0·888	0·837	0·790	0·746	0·705	0·666	0·630	0·596	0·564	6
7	0·933	0·871	0·813	0·760	0·711	0·665	0·623	0·583	0·547	0·513	7
8	0·923	0·853	0·789	0·731	0·677	0·627	0·582	0·540	0·502	0·467	8
9	0·941	0·837	0·766	0·703	0·645	0·592	0·544	0·500	0·460	0·424	9
10	0·905	0·820	0·744	0·676	0·614	0·558	0·508	0·463	0·422	0·386	10
11	0·896	0·804	0·722	0·650	0·585	0·527	0·475	0·429	0·388	0·305	11
12	0·887	0·788	0·701	0·625	0·557	0·497	0·444	0·397	0·356	0·319	12
13	0·879	0·773	0·681	0·601	0·530	0·469	0·415	0·368	0·326	0·290	13
14	0·870	0·758	0·661	0·577	0·505	0·442	0·388	0·340	0·299	0·263	14
15	0·861	0·743	0·642	0·555	0·481	0·417	0·362	0·315	0·275	0·239	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	0·812	0·797	0·783	0·769	0·756	0·743	0·731	0·718	0·706	0·694	2
3	0·731	0·712	0·693	0·675	0·658	0·641	0·624	0·609	0·593	0·579	3
4	0·659	0·636	0·613	0·592	0·572	0·552	0·534	0·516	0·499	0·482	4
5	0·593	0·567	0·543	0·519	0·497	0·476	0·456	0·437	0·419	0·402	5
6	0·535	0·507	0·480	0·456	0·432	0·410	0·390	0·370	0·352	0·335	6
7	0·482	0·452	0·425	0·400	0·376	0·354	0·333	0·314	0·296	0·279	7
8	0·434	0·404	0·376	0·351	0·327	0·305	0·285	0·266	0·249	0·233	8
9	0·391	0·361	0·333	0·308	0·284	0·263	0·243	0·225	0·209	0·194	9
10	0·352	0·322	0·295	0·270	0·247	0·227	0·208	0·191	0·176	0·162	10
11	0·317	0·287	0·261	0·237	0·215	0·195	0·178	0·162	0·148	0·135	11
12	0·286	0·257	0·231	0·208	0·187	0·168	0·152	0·137	0·124	0·112	12
13	0·258	0·229	0·204	0·182	0·163	0·145	0·130	0·116	0·104	0·093	13
14	0·232	0·205	0·181	0·160	0·141	0·125	0·111	0·099	0·088	0·078	14
15	0·209	0·183	0·160	0·140	0·123	0·108	0·095	0·084	0·074	0·065	15

Annuity Table

Present value of an annuity of 1 i.e. $\dfrac{1 - (1 + r)^{-n}}{r}$

Where r = discount rate

n = number of periods

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	1·970	1·942	1·913	1·886	1·859	1·833	1·808	1·783	1·759	1·736	2
3	2·941	2·884	2·829	2·775	2·723	2·673	2·624	2·577	2·531	2·487	3
4	3·902	3·808	3·717	3·630	3·546	3·465	3·387	3·312	3·240	3·170	4
5	4·853	4·713	4·580	4·452	4·329	4·212	4·100	3·993	3·890	3·791	5
6	5·795	5·601	5·417	5·242	5·076	4·917	4·767	4·623	4·486	4·355	6
7	6·728	6·472	6·230	6·002	5·786	5·582	5·389	5·206	5·033	4·868	7
8	7·652	7·325	7·020	6·733	6·463	6·210	5·971	5·747	5·535	5·335	8
9	8·566	8·162	7·786	7·435	7·108	6·802	6·515	6·247	5·995	5·759	9
10	9·471	8·983	8·530	8·111	7·722	7·360	7·024	6·710	6·418	6·145	10
11	10·37	9·787	9·253	8·760	8·306	7·887	7·499	7·139	6·805	6·495	11
12	11·26	10·58	9·954	9·385	8·863	8·384	7·943	7·536	7·161	6·814	12
13	12·13	11·35	10·63	9·986	9·394	8·853	8·358	7·904	7·487	7·103	13
14	13·00	12·11	11·30	10·56	9·899	9·295	8·745	8·244	7·786	7·367	14
15	13·87	12·85	11·94	11·12	10·38	9·712	9·108	8·559	8·061	7·606	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	1·713	1·690	1·668	1·647	1·626	1·605	1·585	1·566	1·547	1·528	2
3	2·444	2·402	2·361	2·322	2·283	2·246	2·210	2·174	2·140	2·106	3
4	3·102	3·037	2·974	2·914	2·855	2·798	2·743	2·690	2·639	2·589	4
5	3·696	3·605	3·517	3·433	3·352	3·274	3·199	3·127	3·058	2·991	5
6	4·231	4·111	3·998	3·889	3·784	3·685	3·589	3·498	3·410	3·326	6
7	4·712	4·564	4·423	4·288	4·160	4·039	3·922	3·812	3·706	3·605	7
8	5·146	4·968	4·799	4·639	4·487	4·344	4·207	4·078	3·954	3·837	8
9	5·537	5·328	5·132	4·946	4·772	4·607	4·451	4·303	4·163	4·031	9
10	5·889	5·650	5·426	5·216	5·019	4·833	4·659	4·494	4·339	4·192	10
11	6·207	5·938	5·687	5·453	5·234	5·029	4·836	4·656	4·486	4·327	11
12	6·492	6·194	5·918	5·660	5·421	5·197	4·988	4·793	4·611	4·439	12
13	6·750	6·424	6·122	5·842	5·583	5·342	5·118	4·910	4·715	4·533	13
14	6·982	6·628	6·302	6·002	5·724	5·468	5·229	5·008	4·802	4·611	14
15	7·191	6·811	6·462	6·142	5·847	5·575	5·324	5·092	4·876	4·675	15

Standard normal distribution table

	0·00	0·01	0·02	0·03	0·04	0·05	0·06	0·07	0·08	0·09
0·0	0·0000	0·0040	0·0080	0·0120	0·0160	0·0199	0·0239	0·0279	0·0319	0·0359
0·1	0·0398	0·0438	0·0478	0·0517	0·0557	0·0596	0·0636	0·0675	0·0714	0·0753
0·2	0·0793	0·0832	0·0871	0·0910	0·0948	0·0987	0·1026	0·1064	0·1103	0·1141
0·3	0·1179	0·1217	0·1255	0·1293	0·1331	0·1368	0·1406	0·1443	0·1480	0·1517
0·4	0·1554	0·1591	0·1628	0·1664	0·1700	0·1736	0·1772	0·1808	0·1844	0·1879
0·5	0·1915	0·1950	0·1985	0·2019	0·2054	0·2088	0·2123	0·2157	0·2190	0·2224
0·6	0·2257	0·2291	0·2324	0·2357	0·2389	0·2422	0·2454	0·2486	0·2517	0·2549
0·7	0·2580	0·2611	0·2642	0·2673	0·2704	0·2734	0·2764	0·2794	0·2823	0·2852
0·8	0·2881	0·2910	0·2939	0·2967	0·2995	0·3023	0·3051	0·3078	0·3106	0·3133
0·9	0·3159	0·3186	0·3212	0·3238	0·3264	0·3289	0·3315	0·3340	0·3365	0·3389
1·0	0·3413	0·3438	0·3461	0·3485	0·3508	0·3531	0·3554	0·3577	0·3599	0·3621
1·1	0·3643	0·3665	0·3686	0·3708	0·3729	0·3749	0·3770	0·3790	0·3810	0·3830
1·2	0·3849	0·3869	0·3888	0·3907	0·3925	0·3944	0·3962	0·3980	0·3997	0·4015
1·3	0·4032	0·4049	0·4066	0·4082	0·4099	0·4115	0·4131	0·4147	0·4162	0·4177
1·4	0·4192	0·4207	0·4222	0·4236	0·4251	0·4265	0·4279	0·4292	0·4306	0·4319
1·5	0·4332	0·4345	0·4357	0·4370	0·4382	0·4394	0·4406	0·4418	0·4429	0·4441
1·6	0·4452	0·4463	0·4474	0·4484	0·4495	0·4505	0·4515	0·4525	0·4535	0·4545
1·7	0·4554	0·4564	0·4573	0·4582	0·4591	0·4599	0·4608	0·4616	0·4625	0·4633
1·8	0·4641	0·4649	0·4656	0·4664	0·4671	0·4678	0·4686	0·4693	0·4699	0·4706
1·9	0·4713	0·4719	0·4726	0·4732	0·4738	0·4744	0·4750	0·4756	0·4761	0·4767
2·0	0·4772	0·4778	0·4783	0·4788	0·4793	0·4798	0·4803	0·4808	0·4812	0·4817
2·1	0·4821	0·4826	0·4830	0·4834	0·4838	0·4842	0·4846	0·4850	0·4854	0·4857
2·2	0·4861	0·4864	0·4868	0·4871	0·4875	0·4878	0·4881	0·4884	0·4887	0·4890
2·3	0·4893	0·4896	0·4898	0·4901	0·4904	0·4906	0·4909	0·4911	0·4913	0·4916
2·4	0·4918	0·4920	0·4922	0·4925	0·4927	0·4929	0·4931	0·4932	0·4934	0·4936
2·5	0·4938	0·4940	0·4941	0·4943	0·4945	0·4946	0·4948	0·4949	0·4951	0·4952
2·6	0·4953	0·4955	0·4956	0·4957	0·4959	0·4960	0·4961	0·4962	0·4963	0·4964
2·7	0·4965	0·4966	0·4967	0·4968	0·4969	0·4970	0·4971	0·4972	0·4973	0·4974
2·8	0·4974	0·4975	0·4976	0·4977	0·4977	0·4978	0·4979	0·4979	0·4980	0·4981
2·9	0·4981	0·4982	0·4982	0·4983	0·4984	0·4984	0·4985	0·4985	0·4986	0·4986
3·0	0·4987	0·4987	0·4987	0·4988	0·4988	0·4989	0·4989	0·4989	0·4990	0·4990

This table can be used to calculate $N(d)$, the cumulative normal distribution functions needed for the Black-Scholes model of option pricing. If $d_i > 0$, add 0·5 to the relevant number above. If $d_i < 0$, subtract the relevant number above from 0·5.

End of Question Paper