Professional Level – Options Module

Advanced Financial Management (Singapore)

Thursday 6 December 2007

Paper P4 (SGP)

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.

The Association of Chartered Certified Accountants

The Institute of Certified Public Accountants of Singapore

Section A – BOTH questions are compulsory and MUST be attempted

1   You are the chief financial officer of International Enterprises, a multinational company with interests in Europe and the Far East. You are concerned about certain aspects of the company's financial management. The company has enjoyed a high rate of growth over the last three years as a result of a single product's development. This product has had a big impact in the fast moving mobile communications industry. However, the company does not have any new products in development and is relying on expanding its market share and developing upgraded versions of the current product.

As part of your preparation for the board meeting to discuss the 2007 draft accounts, you have prepared a projected income statement and balance sheet for the year ending 31 December 2008. These projections are based upon a number of agreed assumptions taken from the company's strategic plan. As part of the agenda, the board will also consider its dividend target for the forthcoming year.

International Enterprises

Income statement for the year ended 31 December	2008 (projected) $m	2007 (draft) $m	2006 (actual) $m
Revenue	288·1	261·9	220·0
Cost of sales	143·2	132·6	104·0
Gross profit	144·9	129·3	116·0
less other operating costs	36·1	27·0	24·0
Operating profit	108·8	102·3	92·0
Finance costs	1·8	2·3	2·3
Profit before tax	107·0	100·0	89·7
Income tax expense (at 30%)	32·1	30·0	26·9
Profit for the period	74·9	70·0	62·8

Balance sheet as at 31 December	2008 (projected) $m	2007 (draft) $m	2006 (actual) $m
Non-current assets (see note)			
Buildings, plant and machinery	168·0	116·0	96·0
Current assets			
Inventories	3·2	3·7	2·3
Receivables	25·6	29·1	19·6
Cash	151·8	155·8	121·7
Total current assets	180·6	188·6	143·6
Total assets	348·6	304·6	239·6
Equity and liabilities			
Paid up share capital			
Ordinary shares (25c)	25·0	25·0	20·0
Other reserves	12·0	12·0	10·0
Retained earnings	216·9	170·0	120·0
less dividends payable	0·0	−28·0	−20·0
	216·9	142·0	100·0
Total equity	253·9	179·0	130·0

Balance sheet continued on the next page.

Balance sheet continued

	2008 (projected) $m	2007 (draft) $m	2006 (actual) $m
Current liabilities			
Trade payables	8·8	7·7	6·4
Tax payable	28·5	25·6	23·3
Dividends payable	0·0	28·0	20·0
Interest payable	1·8	2·3	2·3
Total current liabilities	39·1	63·6	52·0
Non-current liabilities			
Loans	35·0	45·0	45·0
Provisions (deferred tax)	20·6	17·0	12·6
Total non-current liabilities	55·6	62·0	57·6
Total liabilities	94·7	125·6	109·6
Total equity and liabilities	348·6	304·6	239·6

Note	2008 $m	2007 $m	2006 $m
Non-current assets	280·0	200·0	160·0
less accumulated depreciation	112·0	84·0	64·0
Net book value of non-current assets	168·0	116·0	96·0

The projected figures assume:
(i) $10 million of the existing loans will be repaid during the year.
(ii) Capital investment in plant and equipment of $80 million will be undertaken.

The company is quoted on an international stock exchange and its beta value (based upon three years of monthly return data) is 1·40. The current risk free rate is 3% and the equity risk premium is 5%. The current share price is $16·20 and the sector price/earnings ratio is 24. The company's cost of debt capital remains at its current rate of 5%. You may assume that the current cost of equity capital remains unchanged over the term of the projection.

Required:

(a) **Prepare a cash flow forecast for the year ended 31 December 2008.**
Note: the format does not need to comply with accounting standards. (6 marks)

(b) **Estimate the company's maximum dividend capacity after the target level of capital reinvestment is undertaken and making any working capital adjustments you deem necessary.** (6 marks)

(c) **Draft a brief report for senior management reviewing the potential performance of the business in the year ended 31 December 2008 if the expectations contained within the strategic plan are fulfilled. You should use the Economic Value Added (EVA™) and any other performance measures you think appropriate.**

Note: requirement (c) includes 2 professional marks. (18 marks)

(30 marks)

2 Burcolene is a large Asian-based petrochemical manufacturer, with a wide range of basic bulk chemicals in its product range and with strong markets in Europe and the Pacific region. In recent years, margins have fallen as a result of competition from China and, more importantly, Eastern European countries that have favourable access to the Russian petrochemical industry. However, the company has managed to sustain a 5% growth rate in earnings through aggressive management of its cost base, the management of its risk and careful attention to its value base.

As part of its strategic development, Burcolene is considering a leveraged (debt-financed) acquisition of PetroFrancais, a large petrochemical business that has engaged in a number of high quality alliances with oil drilling and extraction companies in the newly opened Russian Arctic fields. However, the growth of the company has not been particularly strong in recent years, although Burcolene believes that an expected long term growth of 4% per annum is realistic under its current management.

Preliminary discussions with its banks have led Burcolene to the conclusion that an acquisition of 100% of the equity of PetroFrancais, financed via a bond issue, would not have a significant impact upon the company's existing credit rating. The key issues, according to the company's advisors, are the terms of the deal and the likely effect of the acquisition on the company's value and its financial leverage.

Both companies are quoted on an international stock exchange and below are relevant data relating to each company:

Financial data as at 30 November 2007

	Burcolene	PetroFrancais
Market value of debt in issue ($bn)	3·30	5·80
Market value of equity in issue ($bn)	9·90	6·70
Number of shares in issue (million)	340·00	440·00
Share options outstanding (million)	25·40	–
Exercise price of options ($ per share)	22·00	–
Company tax rate (%)	30·00	25·00
Equity beta	1·85	0·95
Default risk premium	1·6%	3·0%
Net operating profit after tax and net reinvestment ($ million)	450·00	205·00
Current EPS ($ per share)	1·19	0·44

The global equity risk premium is 4·0% and the most appropriate risk free rate derived from the returns on government stock is 3·0%.

Burcolene has a share option scheme as part of its executive remuneration package. In accordance with the accounting standards, the company has expensed its share options at fair value. The share options held by the employees of Burcolene were granted on 1 January 2004. The vesting date is 30 November 2009 and the exercise date is 30 November 2010. Currently, the company has a 5% attrition rate as members leave the company and, of those remaining at the vesting date, 20% are expected not to have achieved the standard of performance required. Your estimate is that the options have a time value of $7·31.

PetroFrancais operates a defined benefits pension scheme which, at its current actuarial valuation, shows a deficit of $430 million.

You have been appointed to advise the senior management team of Burcolene on the validity of the free cash flow to equity model as a basis for valuing both firms and on the financial implications of this acquisition for Burcolene. Following your initial discussions with management, you decide that the following points are relevant:

1. The free cash flow to all classes of capital invested can be reliably approximated as net operating profit after tax (NOPAT) less net reinvestment.
2. Given the rumours in the market concerning a potential acquisition, the existing market valuations may not fully reflect each company's value.
3. The acquisition would be financed by a new debt issue by Burcolene.

Required:

(a) Estimate the weighted average cost of capital and the current entity value for each business, taking into account the impact of the share option scheme and the pension fund deficit on the value of each company.

(16 marks)

(b) Write a briefing paper for management, advising them on:

   (i) The validity of the free cash flow model, given the growth rate assumptions made by management for both firms;
   (ii) The most appropriate method of deriving a bid price; and
   (iii) The implications of an acquisition such as this for Burcolene's gearing and cost of capital.

   Note: requirement (b) includes 2 professional marks.

(14 marks)

(30 marks)

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Section B – TWO questions ONLY to be attempted

3 Digunder, a property development company, has gained planning permission for the development of a housing complex at Newtown which will be developed over a three year period. The resulting property sales less building costs have an expected net present value of $4 million at a cost of capital of 10% per annum. Digunder has an option to acquire the land in Newtown, at an agreed price of $24 million, which must be exercised within the next two years. Immediate building of the housing complex would be risky as the project has a volatility attaching to its net present value of 25%.

One source of risk is the potential for development of Newtown as a regional commercial centre for the large number of professional firms leaving the capital, Bigcity, because of high rents and local business taxes. Within the next two years an announcement by the government will be made about the development of transport links into Newtown from outlying districts including the area where Digunder hold the land option concerned. The risk free rate of interest is 5% per annum.

Required:

(a) **Estimate the value of the option to delay the start of the project for two years using the Black and Scholes option pricing model and comment upon your findings. Assume that the government will make its announcement about the potential transport link at the end of the two-year period.** (12 marks)

(b) **On the basis of your valuation of the option to delay, estimate the overall value of the project, giving a concise rationale for the valuation method you have used.** (4 marks)

(c) **Describe the limitations of the valuation method you used in (a) above and describe how you would value the option if the government were to make the announcement at ANY time over the next two years.** (4 marks)

(20 marks)

4 The Chairman of your company has become concerned about the accumulation of cash in hand and in the deposit accounts shown in the company's balance sheet. The company is in the manufacturing sector, supplying aerospace components to the civil aviation markets in Asia. For the last 20 years the company has grown predominantly by acquisition and has not invested significantly in research and development on its own account. The acquisitions have given the company the technology that it has required and have all tended to be small, relative to the company's total market capitalisation. The company has a healthy current asset ratio of 1·3, although its working capital cycle has an average of 24 unfunded days.

The company has not systematically embraced new manufacturing technologies nor has it sought to reduce costs as a way of rebuilding profitability. Managerial and structural problems within divisions have led to a number of substantial projects overrunning and losses being incurred as a result. It has also proven difficult to ensure the accountability of managers promoting projects – many of which have not subsequently earned the cash flows originally promised. At the corporate level, much of the company's accounting is on a contracts basis and over the years it has tended to be cautious in its revenue recognition practices. This has meant that earnings growth has lagged behind cash flow.

Over the last 12 months the company has come under strong competitive pressure on the dominant defence side of its business which, coupled with the slow-down in spending in this area across the major Asian economies, has slowed the rate of growth of its earnings. The company's gearing ratio is very low at 12% of total market capitalisation and borrowing has invariably been obtained in the Asian fixed interest market and used to support capital investment in its Asian production facility. In the current year, investment plans are at the lowest they have been in real terms since the company was founded in the 1930s.

In discussion, the chairman comments upon the poor nature of the company's buildings and its poor levels of pay which could, in his view, be improved to reflect standards across the industry. Directors' pay, he reminds you, is some 15% below industry benchmarks and there is very little equity participation by the board of directors. He also points out that the company's environmental performance has not been good. Last year the company was fined for an untreated discharge into a local river. There are, he says, many useful things the company could do with the money to help improve the long-term health of the business. However, he does admit some pessimism that business opportunities will ever again be the same as in previous years and he would like a free and frank discussion at the next board meeting about the options for the company. The company has a very open culture where ideas are encouraged and freely debated.

The chairman asks if you, as the newly appointed chief financial officer, would lead the discussion at the next board.

Required:

(a) In preparation for a board paper entitled 'Agenda for Change', write brief notes which identify the strategic financial issues the company faces and the alternatives it might pursue.   (10 marks)

(b) Identify and discuss any ethical issues you believe are in the above case and how the various alternatives you have identified in (a) may lead to their resolution.   (10 marks)

(20 marks)

5 Your company, which is in the airline business, is considering raising new capital of $400 million in the bond market for the acquisition of new aircraft. The debt would have a term to maturity of four years. The market capitalisation of the company's equity is $1·2 billion and it has a 25% market gearing ratio (market value of debt to total market value of the company). This new issue would be ranked for payment, in the event of default, equally with the company's other long-term debt and the latest credit risk assessment places the company at AA. Interest would be paid to holders annually. The company's current debt carries an average coupon of 4% and has three years to maturity. The company's effective rate of tax is 30%.

The current yield curve suggests that, at three years, government treasuries yield 3·5% and at four years they yield 5·1%. The current credit risk spread is estimated to be 50 basis points at AA. If the issue proceeds, the company's investment bankers suggest that a 90 basis point spread will need to be offered to guarantee take up by its institutional clients.

Required:

(a) Advise on the coupon rate that should be applied to the new debt issue to ensure that it is fully subscribed.
(4 marks)

(b) Estimate the current and revised market valuation of the company's debt and the increase in the company's effective cost of debt capital.
(8 marks)

(c) Discuss the relative advantages and disadvantages of this mode of capital financing in the context of the company's stated financial objectives.
(8 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

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

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

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

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

The Put Call Parity relationship

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

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	0·49987	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

[P.T.O.