INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 2B LIFE INSURANCE **OCTOBER 2009 EXAMINATIONS**

Marking Guide

Level of difficulty

Question	Syllabus Aims	Knowledge & Understanding	Straight - Forward Judgement	Complex Judgement	Total Marks
1(a)	1, 2	3			3
1(b)	10	2			2
1(c)	4		5		5
1(d)	4, 9, 13			7	7
2 (a)	4	2			2
2 (b)	4, 5		6		6
2 (c)	5, 12			8	8
3 (a)	8	2			2
3 (b)	2, 5, 8		6		6
3 (c)	8		3		3
3 (d)	7			6	6
4 (a)	11	3			3
4 (b)	1, 2		2		2
4 (c)	1, 2	3			3
4 (d)	2, 3, 4, 12			8	8
5 (a)	12		4		4
5 (b)	2		4		4
5 (c)	2, 6, 12			8	8
6 (a)	7	4			4
6 (b)	7, 8		4		4
6 (c)	7, 8		6		6
6 (d)	7, 8			4	4
TOTAL		**19**	**40**	**41**	**100**

Answer all 6 questions

QUESTION 1 (17 Marks)

BGG is a listed Australian financial services holding company which has a life insurance subsidiary BGG Life. BGG Life has two statutory funds – Statutory Fund 1 ("SF1") is closed to new business and is wholly comprised of participating business. Statutory Fund 2 ("SF2") comprises investment linked superannuation business and is growing rapidly. The superannuation products sold by BGG Life have entry fees and asset under management fees only. There are no withdrawal fees. Commissions are paid on each premium. You are a consulting actuary specialising in risk management.

a) **Describe the principles of how the policy liability for investment linked business is determined. (3 Marks)**

b) **You have been provided with the following budget for SF2 for the following year (in $'000s). Construct the profit and loss account as it would appear under Australian International Financial Reporting Standards (AIFRS). Assume none of the fees or expenses are deferred.**

Premiums	150,000
Withdrawals	7,125
Fees charged on premiums	7,500
Fees charged on assets invested	1,325
Commission on premiums	7,500
Expenses	5,162
Investment income policyowners	5,961
Investment income shareholders	119
Tax policyowners	22,202
Tax shareholders	-1,116

(2 Marks)

c) **Describe the factors affecting the amount of Regulatory Capital required for SF2? Regulatory Capital for this purpose is the Capital Adequacy Requirement under LPS 3.04 less the policy liability and other liabilities. (5 Marks)**

d) **The directors of BGG are considering closing SF2 and moving this business to a new superannuation trust. The manager of the trust is BST which is also a subsidiary of BGG. The directors have asked for your advice on the implications of this transfer for profit reporting and capital requirements.**

   i) **Describe how profit reporting will change. You may ignore taxation issues and transition costs. (1 Mark)**

ii) List and briefly describe the factors you would consider in developing a policy for the amount of capital to be held by BST. You may assume the regulatory capital requirement for BST is a fixed amount of $5 million. (6 Marks)

QUESTION 1: SOLUTION

a) The principles for determining the policy liability of investment linked business are:

- The policy liability comprises the Life Investment Contract Liability (LICL) and the Management Services Element (MSE).
- The LICL is determined under AASB139.
- The LICL is determined at fair value.
- The LICL cannot be less than surrender value.
- The MSE is determined under AASB118.
- The MSE includes deferred acquisition costs and fee revenue.
- Incremental acquisition costs may be deferred if they are separately identifiable and if it is likely they will be recovered.

Marking guide:
- 0.5 for each point to a maximum of 3 marks (KU)

b)

AIFRS P&L Account	**$'000s**
Income component of premiums	7,500
Investment income	119
TOTAL INCOME	7,619
Expense component of claims	0
Expenses	12,662
Increase in net policy liability	-1,325
TOTAL OUTGO	11,338
OPERATING PROFIT BEFORE TAX	-3,718
Tax	-1,116
OPERATING PROFIT AFTER TAX	-2,603

Marking Guide:
- 1 mark for correct format
- 1 mark for correct numbers

To a maximum of 2 marks (KU).
It is acceptable to leave "expense component of claims" out as it is zero.
Expenses and commission can be shown as two separate items.

c) The components of the capital adequacy requirement are:

- The solvency requirement could dominate. The greater of the solvency requirement and capital adequacy requirement is taken before adding the new business reserve.

- The solvency liability is likely to be the CTV plus 0.25%.
- The expense reserve in the solvency requirement could be significant as the business is growing rapidly. This reserve provides for an overrun of acquisition costs should the fund suddenly be closed to new business.
- The capital adequacy liability is likely to be the CTV plus a margin of 0.5% to 2.5%. The size of the margin will be determined by the appointed actuary based on their assessment of the level of risk in the business. For investment linked business this will mainly depend on the perceived adequacy of the unit pricing process, and other operational risks.
- The new business reserve in the capital adequacy requirement may be significant as the business is growing rapidly and there may be substantial acquisition costs. But there are likely to be capital releases available from SF1 which can be used to reduce the new business reserve, possibly to zero.
- If the management fund or shareholders' fund has capital of more than $5m, the excess over $5m, to a maximum of $5m, can be used as an offset against the new business reserve in the capital adequacy requirement and the expense reserve in the solvency requirement.
- There may be an inadmissible assets reserve in the solvency requirement if the statutory fund has assets dependent upon the ongoing conduct of the business. There are less likely to be inadmissible assets for the capital adequacy requirement.
- There should be no need for resilience reserves in respect of the unit liabilities but there may be a resilience reserve required for the other liabilities.

Marking guide:
- 0.5 for noting that solvency could dominate
- 0.5 for solvency liability
- 0.5 for solvency expense reserve
- 0.5 for noting the impact of business growth on the solvency expense reserve
- 0.5 for capital adequacy liability
- 0.5 for discussing the capital adequacy margins
- 0.5 for capital adequacy new business reserve
- 0.5 for noting the impact of SF1 capital releases on the new business reserve
- 0.5 for offset capital from the management fund
- 0.5 for inadmissible assets reserve
- 0.5 for resilience reserves (unlikely to be significant hence maximum marks can be gained without mentioning this item)

Maximum 5 marks (SJ)

d)

i) Profit reporting will change as follows:
   - Profit emergence will be unchanged as both trust managers and life investment contracts are governed by AASB139 and AASB118.
   - The format of the P&L will change to fees less expenses.

Marking guide:

- 0.5 for noting that the timing of profit emergence does not change
- 0.5 for noting that the format of the P&L changes to fees less expenses

Total 1 mark (CJ)

ii) Factors to consider in determining capital for the trust manager:

- The regulatory capital requirements will be significantly different. The Life Insurance Act solvency and capital adequacy requirements will no longer apply.
- The trust management company will still need to have sufficient capital in order to manage the risks it is incurring. $5 million may not be adequate.
- The directors will need to consider what probability of ruin is acceptable.
- The directors will need to consider the time horizon between the occurrence of adverse experience and management implementing actions to address the problem.
- They will need to consider the risks to the business. The most significant risks to the management company are:
  - Redemption risks in the superannuation trust which the management company may be obliged to fund – e.g. asset prices below unit prices, allowance for selling costs is insufficient, allowance for deferred tax is insufficient
  - Expenses of the management company exceed fee revenue. E.g. due to new business strain or a sudden loss of existing business.
  - Intangible assets not being realisable – e.g. loans to agents, computer software, future income tax benefits.
  - Mismatching of the assets held to cover other liabilities of the management company.
  - Operational risks.
- They will need to consider the diversification of these risks within BST.
- The cost of capital should be considered. The cost of capital (above regulatory requirements) is difficult to determine. As the amount of capital increases, the probability of ruin will decrease. On the other hand, more capital also increases the "agency" risks – management not using capital in the best interests of shareholders.
- They may need to consider the requirements of ratings agencies (if BST intends to issue debt).
- Other potential stakeholders in the superannuation funds (e.g. trustees, members, employers) may have a requirement for minimum financial strength of the trust management company.
- Sources and availability of capital need to be considered. The primary source is likely to be BGG. How mobile is capital within the group?
- Consider the diversification of risks within the BGG group.

- 0.5 for noting that Life Act capital requirements no longer apply
- 1 for noting that capital in excess of regulatory requirements may be necessary
- 0.5 for noting time horizon
- 2 for listing significant risks (0.5 per risk to a maximum of 2 marks)
- 0.5 for noting diversification of risks within BST
- 0.5 for mentioning cost of capital
- 0.5 for a reasonable discussion of the cost of capital
- 0.5 for mentioning rating agencies
- 0.5 for mentioning other stakeholders
- 0.5 for noting sources of capital
- 0.5 for noting diversification of risks within the BGG group

To maximum of 6 marks (CJ)

QUESTION 2 **(16 Marks)**

You are the Appointed Actuary for AXL, an Australian life insurance company. AXL's No. 1 Statutory Fund is comprised entirely of participating business, both investment account (IA) and conventional whole of life and endowment (Conv). The fund has been closed to new business for many years.

The assets of the fund are invested 30% in Australian equities, 20% in international equities and 50% in cash and fixed interest. Shareholder profits are 25% of the cost of bonus or interest credits.

a) Calculate the Capital Adequacy Requirement under LPS 3.04 using the following data.

Item $('000s)	IA	Conv	Total
Policy liability (including cost of declared bonus)	71,282	142,313	213,595
Policy owner retained profits (PRP)	2,213	21,989	24,202
Capital adequacy liability	75,844	144,236	220,080
Current termination value	79,582	125,346	204,928
Other liabilities			1,928
Inadmissible assets			3,281
Resilience reserve			9,521
Solvency requirement			205,643
New business reserve			0
Transitional adjustment			0

(2 Marks)

b) As part of your sensitivity testing you recalculated these numbers assuming current interest rates were 2% lower, future lapses 20% higher and future mortality 20% higher (these sensitivities are independent of each other).

What are likely to be the reasons for the changes (or absence of change) in the results?

Consider the effect of interest rates, lapse rates and mortality rates separately in your answer

Item $('000s)	Interest	Lapses	Mortality
Policy liability (including cost of declared bonus)	234,955	213,595	213,595
Policy owner retained profits	25,412	24,202	24,202
Capital adequacy liability	268,178	218,980	222,281
Current termination value	206,977	204,928	204,928

(6 Marks)

c) AXL's No. 2 Statutory Fund is growing rapidly due to sales of individual risk business. This fund will require more capital in coming years as it continues to grow. The newly appointed Managing Director of AXL tells you that the Policy Owner Retained Profits (PRP) in the No. 1 Fund is effectively a free source of capital to the company. She intends to let PRP grow over the next few years (by reducing the crediting and bonus rates), allowing shareholder capital to be released from the No. 1 Fund and transferred to the No. 2 Fund.

Draft a memo responding to her proposal, including a list of other suggestions for raising capital to support growth in the No. 2 Fund.

(8 Marks)

QUESTION 2: SOLUTION

a) in $('000s)

Greater of CTV and capital adequacy liability = 223,818 (assessed for IA and Conv separately)
Add other liabilities = 225,746
Add inadmissible assets = 229,027
Add resilience reserve = 238,548
Greater of solvency requirement = 238,548

Marking guide: 2 marks – 1 for method and 1 for correct answer (KU)

b)

Interest rates

- Lower interest rates will increase the VSA and hence the policy liability for both IA and Conv.
- The policy liability will increase further if the BEL, calculated using the risk free discount rate, exceeds the VSA (the Adequacy Threshold test).
- The PRP will increase due to the increase in value of the fixed interest assets backing it.
- The capital adequacy liability increases by a large amount, probably because the value of guaranteed benefits increases to such an extent that future bonuses fall to zero under the capital adequacy liability assumptions.
- Current termination values for conventional may increase due to a change in the terminal bonus rate. This is in response to the increase in asset values resulting from the fall in interest rates. They may also increase if the interest rate used to find the surrender value of sum insured and reversionary bonuses is actively managed.

Lapse rates

- Higher lapse rates have no effect on the policy liability as changes to future bonus rates are absorbing their impact.
- There is no impact on the current PRP as only future profits are affected.
- Higher lapses increase future profits for conventional as the policy liability exceeds the CTV. Higher lapses reduce future profits for investment account as the policy liability is less than the CTV. The overall effect of higher lapses for the fund is likely to be higher profits in future. The Capital Adequacy Liability is likely to be equal to the policy liabilities plus PRP less the value of future shareholder profits after allowing for the effect of the adverse conditions assumed. As higher lapses increase the value of future shareholder profits then the Capital Adequacy Liability will reduce as shown.
- Future lapse rates have no effect on the CTV.

Mortality rates

- Higher mortality rates have no effect on the policy liability as changes to future bonus rates are absorbing their impact.
- There is no impact on the current PRP as only future profits are affected.
- Higher mortality rates will reduce future profits. This explains the increase in the Capital Adequacy Liability.
- The mortality rates used in determining the CTV are unchanged.

Marking guide:

- 1 for noting the impact of interest rates on assets included in the VSA and resulting impact on policy liabilities.
- 0.5 for noting the possible impact of the Adequacy Threshold test (if BEL exceeds the VSA) when interest rates fall.
- 1 for noting the impact of interest rates on assets backing the PRP, hence the increase in the PRP.
- 1 for noting the large increase in the capital adequacy liability is likely due to future bonuses in the liability falling to zero when interest rates fall.
- 1 for giving at least one of the two reasons why the CTV increases when interest rates fall.
- 1 for explaining why lapse and mortality rates have no effect on the policy liability
- 0.5 for explaining why lapse and/or mortality rates have no effect on PRP
- 1 for a reasonable explanation for the impact of lapse rates on the capital adequacy liability
- 0.5 for explaining why lapse and mortality rates have no effect on the CTV
- 0.5 for explaining why higher mortality rates will increase the capital adequacy liability

To a maximum of 6 marks – (SJ)

c)

To: MD, AXL
From: Appointed Actuary
Subject: Using No. 1 Fund PRP as capital for No. 2 Fund

Dear MD

I would like to make the following points in response to your proposal to grow the Policyowners Retained Profits (PRP) in the No. 1 Fund by reducing bonus and crediting rates, and to transfer surplus shareholder capital from the No. 1 Fund to the No. 2 Fund.

It is the responsibility of the directors of AXL to decide on how profits should be distributed. However before making any distribution the directors are required by the Life Insurance Act to take advice from the Appointed Actuary on the consequences of the distribution.

The directors should also consider the potential for conflicts of interest between shareholders and policyholders interests and should be aware that the Appointed Actuary's advice in such a situation would need to give adequate protection to policyholders' interests.

The actuary is required to consider the equity of any distribution to participating policy owners. Equity takes into account the reasonable expectations of these policy owners. Reducing the crediting rate in order to build up PRP may not be considered equitable.

The shareholder funds required to support the No.1 fund comprise Shareholders Capital and Shareholders Retained Profits (Participating). The Life Insurance Act requires that Shareholders Retained Profits (Participating) be maintained at a level of at least 25% of PRP. So by reducing the distributions from PRP the distributions to shareholders from the No. 1 Fund could also potentially be reduced. However this restriction will have no impact on the total shareholder funds required in the No. 1 fund if the amount of shareholder funds required to cover the capital adequacy requirement and target surplus exceeds the Shareholders Retained Profits (Participating).

As participating business is no longer sold in Australia there is no direct competitive pressure on crediting rates or bonus rates. However policy owners have many alternative avenues for investment and a reduction in crediting rates and bonus rates is likely to result in an increase in lapse rates. This could increase profits in the short term for the conventional business as CTV is less than policy liability. The reverse is true for investment account. The embedded value may reduce for both classes of business due to the lower volumes of business persisting over the long term.

The crediting rates are likely to be quite low already as the policy liability plus PRP is significantly lower than the CTV.

If PRP is allowed to grow indefinitely it will eventually become large compared to the remaining policy liabilities. There would be issues around what to do with it as the Life Insurance Act only permits it to be distributed to participating policy owners.

Alternative sources of capital for the No. 2 Fund include:

- Raising capital from external sources – either equity or subordinated debt
- Reducing distributions to shareholders (e.g. reducing or eliminating dividends)
- Reinsurance

Yours sincerely
Appointed Actuary

Marking guide:

- 1 for the role of directors and Appointed Actuary in determining distributions
- 1 for the role of directors and Appointed Actuary in conflicts of interest
- 1 for describing the actuary's role in considering the equity of distributions
- 1 for mentioning reasonable expectations of policy owners
- 1 for describing the Shareholder Retained Profits (Participating) requirement to be at least 25% of PRP under the Life Act
- 0.5 for discussing lapse rates and their impact on future profits
- 0.5 for mentioning competition as not being an issue
- 0.5 for realizing that crediting rates may already be very low
- 0.5 for raising the problem of PRP becoming excessive as the business runs off
- 0.5 for stating that PRP can only be distributed to participating policy owners
- 0.5 for capital raising
- 0.5 for mentioning equity and subordinated debt
- 0.5 for increasing retained capital by reducing distributions to shareholders
- 0.5 for use of reinsurance
- 0.5 for use of memo format
- 0.5 for clear use of English

To maximum of 8 marks (CJ)

QUESTION 3 **(17 Marks)**

XYZ is a long-established listed Australian life insurer. One of its main products is Yearly Renewable Term (YRT). This product is profitable and open to new business. The premium rates were increased during the second half of 2009. The YRT product sits in its own statutory fund. The assets of this statutory fund are Australian government bonds. The lapse assumptions, expense assumptions and mortality assumptions for YRT were all changed for the 31/12/2009 valuation. As valuation actuary, you are responsible for calculating an embedded value every 6 months, in addition to calculating the policy liabilities.

a) List the reasons for carrying out an analysis of change for the embedded value. (2 Marks)

b) The Chief Financial Officer (CFO) has asked the following questions about the analysis of change for the embedded value during 2009. What points would you make in reply?

- **Why are the lapse and mortality experience items in the analysis of profit different from the corresponding items in the embedded value analysis?**
- **The mortality experience is poor so why have the assumptions been improved?**
- **If we change the asset mix of the statutory fund so that it includes some higher yielding corporate fixed interest, what will be the impact on the embedded value? (6 Marks)**

c) An actuarial student has produced the following table showing new business volumes and the value of new business for the first half of 2009 (as calculated in July 2009) and for the full year of 2009 (calculated in January 2010). The value of new business for the second half was found by subtracting the first half value of new business from the full year value of new business. You are reviewing the work of the actuarial student.

i) Why is the second half value of new business wrong?

ii) Calculate a better estimate of the second half value of new business.

iii) How would you calculate the first and second half value of new business accurately.

Item $m	1st half	2nd half	Full year
New annual premiums	50	70	120
Value of new business	10.1	17.3	27.4

(3 Marks)

d) The directors have received an offer for the YRT business from QTF, the Australian subsidiary of a foreign multinational insurer. The CFO has seen a forecast that the YRT market will triple in size over the next 15 years. She would like you to use this forecast in estimating an appraisal value for the statutory fund. She needs this for a meeting with her counterpart at QTF tomorrow. What factors would you consider in calculating this appraisal value? (6 Marks)

QUESTION 3: SOLUTION

a) The reasons for carrying out an analysis of change in embedded value are:
- To assist in understanding the results
- To provide information to management and other interested parties
- As a check on the accuracy of the calculations
- To relate the assumptions to experience thus indicating areas where the assumptions may need revising
- To indicate to management where action needs to be taken to improve experience.

Marking guide:
- 0.5 for each point to a maximum of 2 marks (KU)

b) Lapse and mortality experience under embedded value differs from the analysis of profit because:
- Lapse and mortality experience affects the value of future profits and capital releases as well as current year profit. In the Embedded Value analysis of change, future impacts of assumption changes are capitalised and reflected in the current year movement. In the analysis of profit only the current year's experience is reflected as assumption changes are absorbed in profit margins (where they exist).
- In the embedded value analysis value for franking credits at a proportion of face value will be included. The analysis of profit will be either gross or net of tax.

Mortality assumptions may have been improved despite poor experience because:
- The poor mortality experience could be due to a small number of large claims, or random fluctuations in experience from year to year.
- The period of investigation for setting the assumptions is likely to be much longer than 1 year.
- The end of the investigation period will be prior to the valuation date as the assumptions are usually set in advance of the valuation, meaning that the adverse experience may have occurred after assumptions were set.

Impact of a change in asset mix on embedded value:
- The capital required will increase due to a higher resilience reserve. This will cause a reduction in embedded value.
- The investment assumption will increase causing an increase in embedded value.
- The discount rate should increase as the riskiness of the business will increase. This would cause a reduction in embedded value (in theory this should offset the higher investment assumption).
- The net impact should be small and negative.

Marking guide:
- 1 for noting EV lapse experience includes future profits and capital releases.
- 0.5 for explaining analysis of profit only includes current year experience
- 0.5 for noting different tax treatment between the EV analysis of change and the analysis of profit
- 1 for noting mortality experience could be due to random fluctuations or large claims
- 1 for noting the mortality investigation should cover a period of several years
- 0.5 for noting that the period of investigation for assumptions may not correspond to the current valuation year
- 1 for noting higher resilience reserve
- 0.5 for investment assumption increasing the EV
- 0.5 for discount rate reducing the EV
- 0.5 for net impact being small

To a maximum of 6 marks (SJ)

c)

(i) It is wrong to calculate the second half VNB by subtraction as the assumptions for the full year VNB are different to those used for the first half. This means the 2nd half VNB includes the impact of assumption changes on the 1st half's new business.

(ii) An approximate value for the second half VNB can be obtained by pro-rating the full year VNB by sales volumes. 70/120 x 27.4 = 16.0m
Note: this is equivalent to applying the full year new business margin (full year VNB / full year new business volume) to the 2nd half year new business volume.

(iii) This table is showing a split of the full year VNB by 1st and 2nd halves. The 1st half needs to be recalculated using end of year assumptions. The most accurate way of producing this table would be to run first half new business data separately using end of year assumptions. The second half value of new business can be found by subtraction, or by detailed calculations.

Marking guide:
- 1 mark for each item

Total 3 marks (SJ)

d)

- The appraisal value would be based on the embedded value plus a multiple of last year's value of new business.
- Franking credits should be excluded as they have no value to an overseas parent.
- The value of last year's new business may need to be adjusted so that it fully reflects the new premium rates (particularly for level premium business).

- Both EV and value of future new business could be adjusted to allow for lower overhead expenses. These will come from 2 sources – the tripling of new business, and the potential synergies with QTF.
- The new business multiplier will be calculated allowing for growth in sales so they triple over 15 years. The growth rate thereafter should be inflation plus a modest margin allowing for long term economic growth.
- The discount rate used in calculating the new business multiplier should be higher than the EV discount rate to allow for the greater risk.
- Lapse rates for both inforce and future new business could be affected by the sale of the business.
- There could be some allowance for future margin squeeze.
- It may be appropriate to give a range of answers as, due to the short time frame, a crude approach to the calculation of appraisal value is necessary.

Marking guide:
- 0.5 for method EV + multiple x VNB
- 1 for removing franking credits
- 1 for adjusting VNB for premium rate changes
- 1 for adjusting for lower overhead expenses
- 1 for allowing for sales growth in the new business multiplier
- 1 for discount rate used in new business multiplier
- 0.5 for allowing for lapse rates
- 0.5 for allowing for margin squeeze
- 0.5 for giving a range for the appraisal value

Total to a maximum of 6 marks (CJ)

QUESTION 4 **(16 Marks)**

You are the Appointed Actuary for AJAX – an Australian life insurer with a well established portfolio of retail and group risk insurance business, covering term, trauma, total and permanent disability (TPD) and disability income products.

The group disability business has been growing rapidly through the sale of contracts to small to medium sized businesses. These contracts have premium rates guaranteed for 3 years and generally include profit sharing terms, whereby profit share is determined based on each group policy's own experience.

The group disability business is valued using an accumulation method with planned profits emerging as claims are incurred. The business is currently in loss recognition.

a) You require a best estimate claims loss ratio in order to calculate the deficiency reserve. As a first step you decide to calculate the actual claims loss ratio for the latest year. Outline the approach you would take in calculating the actual claims loss ratio. (3 Marks)

b) What additional steps would you take to calculate a best estimate claims loss ratio? (2 Marks)

c) Other than the best estimate claims loss ratio, what other information do you need to calculate the deficiency reserve? (3 Marks)

d) The company is about to sign a group contract with a large professional association. This will be on a non-profit sharing basis. It will have an indefinite term and premium rates may be reviewed annually. The Chief Financial Officer (CFO) is concerned that the new contract may cause the reported profits of the group disability business to become more volatile. He has asked you what actions can be taken to smooth the profits for this business. Draft a memo in reply to the CFO. (8 Marks)

QUESTION 4: SOLUTION

a) The actual claims loss ratio will be cost of claims incurred / premiums earned.

The cost of claims incurred for the year can be calculated as:

- IBNR + RBNA + CICP;
  - where all items are calculated at the valuation date on current best estimate assumptions;
  - only claims incurred during the year are included;
  - all items are discounted to date incurred (probably midyear on average) using the risk free interest rate applying at the valuation date.
- plus actual claim payments made during the year for claims incurred during the year, again discounted back to date incurred.

The premiums earned for the year can be calculated as:

- premiums received less increase in unearned premium reserve (which could be expressed as the expected premiums earned on the schemes exposed over the year)

Marking guide:
- 0.5 for formula for claims loss ratio formula
- 0.5 for including all claim components
- 0.5 for only including items incurred during the year
- 0.5 for discounting to date incurred
- 1 for premiums earned

Total 3 marks (KU)

b) The best estimate claims loss ratio will:

- Use a longer investigation period as one year is unlikely to be credible
- Consider trends in the experience
- Consider probable future trends (e.g. changes in experience due to the economic downturn)
- Other sources of information could be considered (e.g. industry analyses, reinsurers).
- Any change in premium rates during the investigation period needs to be allowed for.

Marking guide:
- 0.5 for each

To a maximum of 2 marks (SJ)

c) Other information required to calculate the deficiency reserve include best estimates of:

- renewal expenses (including claims expenses)

- risk free interest rates
- lapse rates
- premiums inforce at the valuation date
- unearned premiums at the valuation date
- the period until premium rate guarantees expire

There will also have to be an allowance for the asymmetry in the profit sharing. Profit shares for some policies will be greater than zero, even though the disability business as a whole may be in loss recognition.

Marking guide:
- 1 for including allowance for the profit sharing asymmetry.
- 0.5 for each of the other items.

To a maximum of 3 marks. (KU)

d)

To: CFO, AJAX Life
From: Appointed Actuary
Subject: New Group Disability Contract

Dear CFO

I understand your concerns about the potential volatility of profit from the new disability contract and your desire to smooth profits. However there are a number of restrictions which limit the ability of the company to smooth profits.

The Life Act requires Appointed Actuaries to comply with actuarial standards including AS1.04.

AS1.04 requires best estimate assumptions to be used in determining policy liabilities, so deliberately lowering (or overstating) the results is prohibited. It is not possible to smooth the profits by using other than best estimate assumptions.

There will naturally be some smoothing of the best estimate assumptions since the assumptions are based on experience over several years and extremes of experience tend to be ignored in setting assumptions for the future.

The auditors / actuarial auditors will be auditing my valuation and any deliberate bias in the valuation will most likely be detected.

My advice to the Board is to assist them in signing off that the financial statements give a true and fair view of Book Life's financial position and that they comply with relevant accounting and professional standards.

AS1.04 includes a concept called a Related Product Group (RPG). The requirements for establishing a separate RPG for the new contract are subjective – it depends on how similar the benefit characteristics and pricing structures are to the

existing group disability contracts. The new contract has some differences with the existing disability portfolio but the differences are not obviously sufficient to require a separate RPG.

The Standard requires that capitalised losses must be assessed at the RPG level.

If the new contract is combined with the existing contracts in a single RPG, the profits from the new contract will be capitalised to the extent that they can be offset against the capitalised losses from the existing contracts. This will cause a jump in profits for this reporting year followed by a fall in expected profit next year.
In future years I would expect profit to be more stable with a single RPG as further capitalised losses are less likely to occur with a single RPG. Losses in one part of the RPG can be offset against profits in other parts.

One problem with having two RPGs is that the solvency and capital adequacy requirements may be higher. If there are two RPGs the MTV / CTV minimum will apply at a finer subdivision of the business. In addition the solvency liability must not be less than the BEL for each RPG.

Under the method used for determining policy liabilities for the existing contracts profit margins emerge as claims are incurred. An alternative is to changes the method so that profit emerges as claims are paid. Under the current method changes in CICP, IBNR and RBNA flow directly to profit. It would be possible to add profit margins to each of these reserves, effectively spreading the emergence of profit over a longer period. The profit margins would act as a dampener – absorbing the changes in CICP, IBNR and RBNA which are due to changes in non-economic assumptions. This would reduce the profit emergence from the new contract in the first year or two as these profit margins accumulate.

There would not be any impact on the solvency or capital adequacy requirements as profit margins do not form part of these requirements.

In order to minimise profit volatility the assets backing the group disability business should be highly rated fixed interest securities matched to the term of the liabilities.

Further reduction in volatility could be achieved through reinsurance. This would reduce the profits expected from the business but would also reduce the capital requirements. A stop loss arrangement could be used to put a limit on potential losses. Alternatively a quota share arrangement could be used.

Regards
Appointed Actuary

Marking guide:

- 0.5 for Life Act requiring adherence to AS1.04
- 1 for AS1.04 requiring use of best estimates
- 0.5 for smoothing incorporated in best estimates
- 0.5 for mentioning auditors
- 0.5 for Board sign-off of financial statements

- 1 for describing requirements for RPGs
- 1 for describing loss reversal if the new contract is included in the existing RPG
- 0.5 for mentioning future profits are more volatile if there are two RPGs
- 0.5 for mentioning RPGs impact on solvency and capital adequacy (note that although the question did not specifically ask about solvency and capital adequacy, the CFO would need to know about these impacts).
- 1 for describing the effect of adding profit margins on CICP, IBNR and RBNA
- 0.5 for describing the effect of these profit margin reserves on Solvency and Capital Adequacy
- 0.5 for assets being highly rated fixed interest
- 0.5 for assets matching the term of the liabilities
- 0.5 for mentioning reinsurance
- 0.5 for describing the impact of reinsurance on profit and capital
- 0.5 for describing different types of reinsurance
- 0.5 for using memo format
- 0.5 for appropriate language

To a maximum of 8 marks (CJ)

QUESTION 5 **(16 Marks)**

You are the Appointed Actuary for NHY Ltd – a large Australian life insurer with a range of business including traditional participating business, risk business, annuities and investment linked business. A new and virulent strain of flu is rapidly spreading through the community. A number of medical experts are forecasting an increase in mortality rates of the order of 50%. Approximately 30% of the population are expected to become ill from catching the virus, with the average duration of illness being 10 days.

a) List the sections in your Financial Condition Report where you would expect to comment on the impact of the pandemic. (4 Marks)

b) You are preparing to value the Yearly Renewable Term (YRT) policy liabilities at 31/12/2009. You intend to increase your best estimate mortality rates by 50% for 2010 after which they will revert to the previous long-term assumption. You have decided to change the renewal expense assumptions and the economic assumptions.

An actuarial student has presented you with the following output from the valuation system (values in $million).

	BEL	PV Claims	1st year claims
Business inforce at start of year			
Basis A (old assumptions)	-63	442	35
Basis B (old assumptions, except new economic)	-55	499	35
Basis C (new assumptions, except old mortality)	-58	485	35
Basis D (all new assumptions)	-41	502	52
New business at inception *			
Basis E (new assumptions, except old mortality)	-21	89	
Basis F (all new assumptions)	-19	91	
New business at valuation date			
Basis G (new assumptions, except old mortality)	-25	91	4
Basis H (all new assumptions)	-23	93	6

*** The BEL for new business at inception includes all acquisition costs.**

The profit margin carried forward from 31/12/2008 is 30% of claims.

Calculate the planned profit for 2010 on 2 bases – with and without the change in mortality assumptions. (4 Marks)

c) Your calculations show that planned profit for 2010 is higher if you change the mortality assumptions and retain best estimate claims as the profit carrier. What actions could you take in order to achieve a more reasonable planned profit? (8 Marks)

QUESTION 5: SOLUTION

a) The issues included in the FCR where comments about the impact of the pandemic will be appropriate are:

- Policy liabilities and profit
- Embedded or appraisal value
- Pricing – premium rates for new and existing business, and conditions for accepting new business.
- Solvency and capital adequacy requirements
- Target surplus
- Additional capital requirements
- Sources of additional capital
- Distributions to shareholders and participating policy owners
- Adequacy of reinsurance
- Operational risks (e.g. impact on unit pricing if staff are all sick)
- Suitability of investments – liquidity requirements for increased outflows

Marking guide:

- 0.5 for each point with maximum 4 marks. (SJ)

b)

Step 1 – value of future profits for in-force

VFP = BEL (basis B) + value future profits (basis B) – BEL (basis C or D)
= 152.7 (old mortality)
= 135.7 (new mortality)

Step 2 – calculate profit margins on new business at inception.

Profit margin = -BEL / PV claims
= 23.6% (old mortality)
= 20.9% (new mortality)

Step 3 – calculate value of future profits for new business at the valuation date

VFP = profit margin x PV Claims
= 21.5 (old mortality)
= 19.4 (new mortality)

Step 4 – calculate profit margin for in-force and new business combined

Profit margin = VFP / PV Claims
= 30.2% (old mortality)
= 26.1% (new mortality)

Step 5 – calculate planned profit for 2010

Planned profit = profit margin x expected claims in 2010
= 11.8 (old mortality)
= 15.1 (new mortality)

Marking guide:
- 1 mark for each of steps 1-3, 0.5 for each of steps 4 and 5.
- Note it is possible to combine some steps. Award full marks if the correct answers are arrived at in step 5.

Total 4 marks. (SJ)

c)

- AS1.04 requires that best estimate assumptions must be used in determining the policy liability. Therefore the 50% loading on mortality rates for 2010 should be used for calculating the BEL.

- The future profits are positive even with the increase in mortality for 2010 so the basis chosen will have no effect on profit reported in 2009.

- The basis chosen will affect the emergence of profit in 2010 and beyond.

- The profit carrier must be chosen so that profits are earned on the later of the provision of a service to the policy owners and the receipt of income relating to that service.

- Using best estimate claims as the profit carrier will bring forward the release of profits in 2010. Whilst this conforms to the principles of AS1.04 (the service is provided when claims are made) it is not reasonable to report higher profits as the result of a pandemic.

- The profit carrier can be changed providing this does not result in a release of profit at the date of change.

- Alternative profit carriers are premiums and long-term claims (that is without the spike in mortality in 2010).

- Using premiums as the profit carrier would bring forward the release of profit margins but not as much as using best estimate claims. Again it does not seem reasonable to report higher profits as a result of a pandemic.

- Using long-term claims (i.e. excluding the increase due to the pandemic) as the carrier will result in a slightly lower profit in 2010 and all subsequent years as a result of the pandemic. This is because the extra death claims expected in 2010 will increase the BEL and reduce the value of future profit margins at 31/12/2009. But the value of the profit carrier at 31/12/2009 will be unchanged. Therefore the profit margin (and planned profit emergence in all future years) will be slightly lower as a result of the pandemic.

- Retaining the old mortality assumptions would allow the extra claims in 2010 to emerge as an experience loss. The extra claims could be treated as a one-off and not included in the best estimates. This is similar to the concept of one-off expenses which are allowed for in AS1.04. But AS1.04 does not mention one-offs in regard to other assumptions.

- The assumptions and choice of profit carrier should be discussed with:

- Auditors (as they will have to approve it)
- Senior management (as they need to be aware of the effect on future profit emergence)
- Other members of the actuarial profession.

Marking guide:

- 1 mark for each point or any other well reasoned suggestion to a maximum of 8 marks (CJ)

QUESTION 6 **(18 Marks)**

PRIME is an Australian subsidiary of a Belgian multinational insurance company. It has a range of life insurance products including traditional participating business, investment linked and lump sum term. The participating business is no longer sold.

For several years PRIME has been calculating a traditional embedded value (TEV). The risk discount rate is the same for all products. PRIME has now been asked to restate the embedded value using Market Consistent Embedded Value (MCEV) principles.

The MCEV will be presented as having the following components:
- **Value of Inforce (VIF)**
- **less Cost of Capital (CoC)**
- **plus Adjusted Net Worth (ANW)**

The Value of Inforce (VIF) is:
- **the present value of future profits (excluding investment returns on capital)**
- **less the time value of financial options and guarantees (TVFOG)**

The Cost of Capital is:
- **the frictional costs of required capital**
- **plus the cost of non hedgeable risks**

Adjusted New Worth (ANW) is made up of:
- **required capital (RC)**
- **plus surplus capital (SC)**

The parent company has specified that the "Certainty Equivalent Method" be used. Under this method both the gross investment earnings assumption and the risk discount rate are equal to the prevailing risk free interest rate. For business with significant financial options and guarantees, a stochastic model is used to calculate the TVFOG.

The cost of non-hedgeable risks is the change in the value of future profits and releases of required capital resulting from the addition of a margin of 1% to the risk discount rate.

The required capital is the amount of shareholder capital required to meet the capital adequacy requirement. The frictional costs of the required capital are the present value of the tax on future investment earnings and the investment management expenses for the required capital.

a) List the key differences between MCEV and TEV. (4 Marks)

b) Calculate the expected values for MCEV of the VIF, CoC and ANW at the end of the year given the following MCEV data at the start of the year:

Risk Free Rate	5%
Tax Rate	30%
VIF	972
CoC	167
RC	220
SC	55
ANW	275
1st Year Profit *	66

*** the 1st year profit excludes investment returns on shareholder capital and is net of tax.**
Assume the profit release and changes to required capital occur at the end of the year.
Investment management expenses are assumed to be immaterial.
(4 marks)

c) How would you expect the MCEV to differ from the TEV for each of the 3 classes of business mentioned in the first paragraph of the question? [Note: you can assume Surplus Capital is not allocated to classes of business for either MCEV or TEV]. (6 Marks)

d) What changes would you expect the company to make to products and capital management as a result of the adoption of MCEV (instead of TEV) as a key performance measurement for the company? (4 Marks)

END OF PAPER

QUESTION 6 SOLUTION

a) The key changes in methodology are

- the use of a risk free rate of investment return instead of best estimate.
- the discount rate will be the risk free rate plus 1%. Under the traditional method the discount rate would be risk free plus a margin of typically 3% to 5% reflecting an equity risk premium.
- There is an explicit deduction of the time value of financial options and guarantees for MCEV. Under TEV the allowance for the value of financial options and guarantees is implicit in the choice of discount rate.
- The VIF for MCEV only includes future profits (excluding investment returns on required capital). For TEV the VIF includes investment returns (net of tax and investment expenses) on regulatory capital and the present value of releases of regulatory capital.
- The ANW for MCEV includes both required capital and surplus capital. The ANW for TEV only includes surplus capital.
- The changed definitions of VIF and ANW don't affect the total EV. It is just a different way of splitting it.
- MCEV includes an explicit cost of capital. For TEV it is implicitly included in the VIF.

Marking guide:

- 0.5 for identifying the change in investment return assumption
- 0.5 for stating that TEV uses a best estimate investment return
- 0.5 for identifying the change in discount rate
- 0.5 for quoting a typical discount margin for TEV
- 0.5 for identifying that TVFOG is explicit in the MCEV
- 0.5 for stating that TVFOG is implicitly allowed for in the discount rate for TEV
- 0.5 for change in definition of VIF
- 0.5 for change in definition of ANW
- 0.5 for comment on cost of capital

Up to maximum of 4 marks (KU)

b) The VIF is discounted at the risk free rate. Deduct the profit emerging.
VIF at end of year = 972 * 1.05 – 66 = 954.6

The ANW rolls up with interest net of tax. Add the profit emerging.
ANW at end of year = 275 * 1.035 + 66 = 350.6

The CoC at the end of the year can be deduced as follows:
The value of distributable profits (VIF – CoC + RC) rolls up at the risk free rate plus the 1% margin. The VIF rolls up at the risk free rate. The RC rolls up at the risk free rate net of tax. CoC can be calculated as a balancing item.

CoC at end of year = (972 – 167 + 220) * 1.06 – 972 * 1.05 – 220 * 1.035 = 161.8

Marking guide:
- 0.5 for VIF rolling up at the risk free rate
- 0.5 for deducting profit emerging from VIF and getting the correct answer for VIF
- 0.5 for ANW rolling up with interest less tax
- 0.5 for adding profit emerging to ANW and getting the correct answer for ANW
- 0.5 for (VIF – CoC + RC) rolling up at the risk free rate plus 1%
- 0.5 for RC rolling up at the risk free rate net of tax
- 1 for correctly deducing CoC.
- There are alternative ways of calculating CoC. Award 2 marks if the correct answer is given.

Total 4 marks (SJ)

c) Comparison of MCEV and TEV

Participating business:
- The main factor determining the future profitability of participating business is the level of future investment returns.
- If there is a significant proportion of equities and/or property in the asset mix backing the participating business, the MCEV will use a much lower investment return assumption than the traditional EV.
- In addition there is a deduction for the time value of financial options and guarantees. This could be significant if there are equities and/or property in the asset mix.
- The impact of lower future investment returns and the deduction for TVFOG are likely to be bigger than the impact of the lower discount rate (unless the asset mix if predominantly fixed interest).
- The MCEV is expected to be lower than the traditional EV.

Investment linked:
- The profitability of investment linked business is determined by fees less expenses.
- Asset based fees are typically the main contributor to profits.
- Under MCEV the asset based fees and investment management expenses will be projected to grow at a lower rate than for traditional EV (if typically a majority of the assets are equities and property).
- However the lower discount rate will offset the effect of lower future investment returns. The present value of asset based fees less expenses will be little different for MCEV and TEV. The precise relationship will depend on the asset mix and the discount margin that was used for the TEV.
- Some fees and expenses are a percentage of premium or a fixed dollar amount per policy (perhaps increasing with CPI). The change in the investment return assumption for MCEV will have no effect on the projection of these fees and

expenses. The lower discount rate will increase their present value. To the extent that there is any mismatch between these fees and expenses the MCEV could be different from the traditional EV.
- The MCEV is expected to be similar to the traditional EV.

Lump Sum Term:
- The assets required for lump sum term business are typically quite small, since the capital adequacy requirement is usually driven by the CTV which will be small.
- In addition the asset mix is typically mainly fixed interest.
- The change to the investment return assumption will therefore have only a small impact on future profits (where these include the investment return on capital).
- The lower discount rate will have a much larger impact than the lower investment return assumption, assuming a reasonable level of profits.
- The MCEV is expected to be higher than the TEV if the business is profitable.

Marking guide

Participating:
- 0.5 for dependency of profit on investment return
- 0.5 for lower investment return – dependency on asset mix
- 0.5 for change in discount rate having a smaller effect than the change in investment return
- 0.5 for possible impact of TVFOG
- 0.5 for concluding that MCEV will be lower than TEV

To a maximum of 2 marks

Investment linked:
- 0.5 for profit depending on fees less expenses
- 0.5 for change in discount rate offsetting change in investment return for asset based fees and expenses.
- 0.5 for profit largely coming from asset based fees
- 0.5 for discussing fees and expenses based on premiums and fixed dollar amounts
- 0.5 for concluding MCEV and TEV probably similar

To a maximum of 2 marks

Term:
- 0.5 for noting small assets required
- 0.5 for noting typical asset mix mainly fixed interest
- 0.5 for discount rate effect being bigger than investment earnings effect
- 0.5 for concluding MCEV higher than TEV

To a maximum of 2 marks

Total for all 3 types of business – to a maximum of 6 marks (SJ)

d) Changes following on from adoption of MCEV may include:

- Pricing should be changed to be consistent with the MCEV methodology.
- Term is likely to become a more attractive product (if profitable).
- Greater sales focus on term business.
- Possible increase to commission rates for term.
- There may be opportunities to reduce the prices of term.
- There should be a greater weighting of assets towards fixed interest (except for investment linked). Risky assets depress the MCEV as the capital adequacy requirement is higher and there is no compensating increase in future investment returns.
- For the participating business there should be a greater focus on reducing the TVFOG (subject to policy owner reasonable expectations). This can be done through manipulating the asset mix, perhaps including the use of derivatives.
- There is unlikely to be any effect on the pricing or product design of investment linked business

Marking guide:

- 1 for revising the pricing basis
- 1 for increased sales focus on term (if profitable)
- 0.5 for increasing commission for term
- 0.5 for reducing prices for term
- 1 for moving to a more conservative asset mix (generally)
- 0.5 for greater focus on TVFOG for participating business
- 0.5 for mentioning policy owner reasonable expectations as a constraint on changing the terms for participating business.
- 0.5 for little impact on investment linked business
- 0.5 for any other relevant points (up to a maximum of 1 mark)

To a maximum of 4 marks (CJ)