INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 2B LIFE INSURANCE
MAY 2005 EXAMINATIONS

MARKING GUIDE

Level of Difficulty

Question	Syllabus Aims	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1a	1	1	3	4		7
1b	1	1		2		2
1c	1	1		3		3
2a	10,11	5		5		5
2b	10,11	5		8		8
2c (i)	10,11	5	1			1
2c (ii)	10,11	5			3	3
3a	1,2	1	2			2
3b	1,2	1	1			1
3c (i)	1,2	1	2			2
3c (ii)	1,2	1		2		2
3c (iii)	1,2, 5	1, 2		2		2
4a (i)	2	1	5			5
4a (ii)	2	1		2		2
4a (iii)	2	1		2		2
4a (iv)	2	1	1			1
4b	2, 3, 4	1,2			15	15
5a	6	3	1			1
5b	6	3	3			3
5c (i)	6	3		1		1
5c (ii)	6	3		1		1
5c (iii)	6	3		2		2
5d	8,9,12	3,6		4		4
5e	Course A, 5	A2			4	4
5f	12	6			6	6
6a (i)	7, 9	4		2		2
6a (ii)	7, 9	4			3	3
6a (iii)	7, 9	4			7	7
6b	5, 7, 9	2, 4			3	3
TOTAL			**19**	**40**	**41**	**100**

Answer all 6 questions.

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QUESTION 1 **(12 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	1	3	4		7
Part b)	1		2		2
Part c)	1		3		3
Total		3	9		12

Question

You are the valuation actuary at AAA Life. Your company has recently issued a new term insurance product. This new product allows policyholders to take TPD riders. None of your products have had TPD benefits before.

(a) Outline the high level steps you would undertake to enable you to calculate the TPD IBNR reserve for the first time. Include in your answer the sources of data you would consider. (7 marks)

(b) It is now 5 years since commencement of this product and the company has been very successful and built up a considerable portfolio of TPD business. There have been no changes to the TPD IBNR calculation approach since the benefit was first issued. What changes would you make to your approach in part (a) in order to calculate the TPD IBNR reserve? (2 marks)

(c) Having updated your approach, you have calculated your IBNR reserve using the two methods (part (a) and part (b)) and found that the IBNR under (b) is significantly higher than under (a). Why may this have occurred? (3 marks)

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QUESTION 1 SOLUTION **(12 Marks)**

(a) Approach to be used includes

- Research possible formulae that could be used to calculate IBNR reserves, such as a loss ratio with average deferral period or a claim development table, (a source may be the method used for term insurance IBNR reserves) and select the method to be used.
- Once method selected determine the assumptions required. Identify possible data sources (see below).
- Policy information has to be obtained to allow for the differences in product terms underlying the source data and AAA's product. These differences would need to be considered to determine how they would affect the occurrence and reporting of claims.
- Selection adjustments would also be considered, as the results will be applied to a block of new business.

1 mark each valid point, to a maximum of 4.

As we have no experience we will have to obtain information from external sources.

Sources are:

- Industry papers, particularly the mortality and morbidity reports of the IAAust
- Overseas experience
- Use pricing information
- Discussion with reinsurer/other actuaries of companies that do have this business
- Company accounts of other life insurers
- Consulting companies

1 mark per point, max 3 marks.

(b) At this point in time we have sufficient experience for our own portfolio to consider updating the IBNR reserve calculation.

- Consider whether you would change your approach or change assumptions only (e.g. changing from a simple loss ratio approach to a run-off table).
- An investigation of claims would need to be undertaken. The information required is the date of occurrence of the injury, the waiting period under the policy, and the date at which the claim is reported to the company.
- Check the credibility of your results and compare to the industry results and decide what weight to give to the company experience relative to industry experience.
- Data would be analysed to identify the number of claims terminated by duration in force.
- Adjustments would then need to be made to allow for the proportion of claims usually paid compared to those reported.

0.5 mark for each step/consideration to a maximum of 2.

(c) There are a number of possible reasons why this result may have occurred, including:

- More claims were incurred than were expected under the pricing basis.
- The initial adjustment for differences between AAA's own policy conditions and that underlying the industry data may have been incorrect.
- AAA's underwriting and claims staff may be less experienced with TPD business. This may have had an impact on claims experience.
- Experience showed that the reporting delay period was greater than expected.
- A higher rate of claims is occurring in larger size policies (i.e. the claim incidences are skewed towards the larger sums insured).
- The selection adjustments made to the industry figures may have been too high.
- Older duration policies may have lower overall claim rates, as people have forgotten about the policy, what it covers, or agents may be less involved. This may have a dilution effect on a larger portfolio in force for longer than 5 years.

1 mark per point made, maximum of 3 marks.

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QUESTION 2 **(17 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	10,11		5		5
Part b)	10,11		8		8
Part c) i)	10,11	1			1
Part c) ii)	10,11			3	3
Total		1	13	3	17

Question

You are a consulting actuary who is reviewing an embedded value calculation for an investment bank. The investment bank has been asked to negotiate the sale of a life insurance company.

Company A is a small Australian life insurance company owned by an overseas parent (OS Co). OS is trying to sell Company A.

DOM Co is a large listed Australian life insurance company. DOM is interested in buying Company A.

The investment bank has provided you with the following information on the valuations performed on Company A by the seller (OS) and the buyer (DOM).

Assumptions used in calculating the embedded value of Company A		
Company Undertaking the Valuation	**OS[1]**	**DOM**
Assumption differences		
Risk discount rate	**12.5%**	**11.5%**
Mortality (% of IA 90-92)	**85%**	**80%**
Renewal Expenses (% of premium)	**16.3%**	**12.5%**
Franking Credit Value Factor[2]	**0%**	**70%**
Embedded Value ($m)	**133**	**180**

Note: 1 OS have calculated the embedded value of Company A on a stand-alone (business as usual) basis.
2 This is the proportion applied to the face value of franking credits when calculating embedded values.

(a) Why might the assumptions used by DOM for the calculation of the embedded value differ from those used by OS? (5 marks)

(b) The investment bank has calculated a value of Company A based on an approach using a P/E (Price to Earnings) ratio. What are the advantages and disadvantages of calculating the embedded value using a discounted cash flow approach when compared with the P/E approach used by the investment bank? (8 marks)

(c) The investment bank has asked you about target surplus.

(i) Explain the concept of target surplus to the investment bank. (1 mark)
(ii) Should you revise your valuation to allow for target surplus? (3 marks)

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QUESTION 2 SOLUTION **(17 Marks)**

(a)

Mortality

- Mortality may differ because, while OS (the current owner of company A) is basing its assumption on the experience of this block of business (and possibly industry information), DOM may be using information from its existing life insurance business, which may differ.

- DOM may be of the opinion that its claims management processes are superior to those of Company A.

Expenses

- For OS, it may be using Company A's own expense experience. DOM is a much larger company and may therefore be using its own expense base assumptions.

- DOM may anticipate improvements in expenses due to economies of scale or other expense savings once the Company A business is merged with its existing business.

Risk Discount Rate

- The shareholders and management of DOM and OS may have different views on the return on capital they require.

Franking Credit Valuation Factor

- OS is an overseas company and is not able to use franking credits, thus franking credits have no value to them.

- DOM is a listed Australian based entity and is able to use franking credits and thus they represent value to them.

1 mark each for each valid point, maximum of 5 marks. This should only be awarded if all 4 areas of the solution are covered.

(b)

Advantages of DCF embedded value compared to a P/E approach

- Takes into account the cash flows of the business and its specific circumstances, i.e. it accurately represents the owners' real stake in the business.

- The source of the embedded value can be explained in terms of projected cash flows based on the current business position. This assists in communication of results and reasonableness checking.

- The projected cash flows and statistical items are also useful for future analyses of change.

- The embedded value takes into account the risks associated with investing in the business by using the risk discount rate. It's unclear what risk allowances are included in the P/E method.

- There is explicit allowance for the release of capital.

- Sensitivity tests to assumptions can be conducted.

Disadvantages compared to a P/E approach

- It can be difficult to model complex products accurately (e.g. disability income insurance and corporate superannuation investment business).

- Embedded value calculations require many assumptions and a projection model. This can make it difficult to prepare an embedded value in a timely manner. A P/E valuation can usually be completed in a very short period.

- Embedded Values can also be difficult to explain to non-technical people.

- The embedded value does not include any value of new business that might be written by Company A; this may be implicit in the P/E multiple used by the investment bank.

- There is very little empirical data about many of the key parameters in an embedded value calculation (such as risk discount rate and the franking credit valuation factor). Conversely P/E ratios are regularly published.

- The results are usually very sensitive to the particular assumptions selected. Furthermore, it may not be valid to assume the current assumptions will remain constant over the longer term. For example, expenses often vary from year to year but embedded values are often undertaken assuming fixed unit costs for many years.

1 mark for each point, maximum of 8 marks.

(c)

(i) A Target Surplus policy is the practice of holding a level of shareholder free capital in excess of the Capital Adequacy Requirement. The reason it is considered necessary to have a Target Surplus policy is that the Capital Adequacy standard is only indicative of the level of reserves that a company needs to hold to meet the needs of the company, including satisfying its policyholder obligations. It is generally accepted that free reserves above this level should be maintained to ensure that any unusual events do not expose the fund to breaching the Capital Adequacy requirements.

1 mark

(ii) Either answer, yes or no, is fine, as long as it is justified.

The no answer is:

- No, because doing this would mean that the target surplus, a current dollar amount, would be projected in all future years. The release of target surplus will be discounted at the RDR. This is likely to mean that it will be valued at less than its current face value (due to the cost of capital).

- Target surplus is not a regulatory capital requirement, so it is not necessary to treat it as locked in capital for long term projections.

- Different practitioners may have significantly different views as to target surplus policy (as evidenced by current market practices). It is not appropriate to include target surplus until there is greater consistency in the market.

- Currently it is not common market practice to allow for target surplus in embedded value calculations. Including target surplus will lower the embedded value and thus cause a company to be at a relative disadvantage.

The yes answer is:

- Yes, because providing target surplus is something that uses up the capital of the business, even though it's not a legal requirement. This capital could be used for other things, such as writing a new product. The shareholders should demand a return on capital for target surplus.

3 marks for clear and valid argument for either answer.

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QUESTION 3 **(9 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	1,2	2			2
Part b)	1,2	1			1
Part c) i)	1,2	2			2
Part c) ii)	1,2		2		2
Part c) iii)	1,2, 5		2		2
Total		5	4		9

Question

You are the valuation actuary at BHB Life Insurance calculating the policy liabilities for a block of 10 year yearly renewable term business at 31 December 2004. You have been provided the following projection results for the in-force business as at 31 December 2004. This is shown separately for business sold in 2004 and business sold prior to 2004. Both sets of projections have used the 2004 best estimate assumptions (i.e. Basis 2 assumptions). These were identical to the best estimate assumptions for the previous year (2003). The results (all figures are in $'000) are as follows:

<u>Business Sold Prior to 2004</u> (i.e. excludes new business written in 2004):

Year	Premium	Claims	Initial Expenses	Renewal expenses	Planned Profit[1]
2005	7,260	2,541	-	2,855	1,271
2006	6,454	2,323	-	2,690	1,162
2007	5,219	1,931	-	2,306	966
2008	4,148	1,576	-	1,943	788
2009	3,203	1,249	-	1,590	625
2010	2,423	969	-	1,275	485
2011	1,744	715	-	973	358
2012	1,237	520	-	732	260
2013	878	378	-	550	189
2014					
PV @ earning rate	26,278	9,282	0	10,659	4,641

Note 1: This has been calculated using the final 2003 profit margin.

<u>Business sold in 2004</u> (projected from 31 December 2004):

Year	Premium	Claims	Initial Expenses	Renewal expenses	Planned Profit[2]
2005	4,001	1,282	-	1,485	545

2006	**2,893**	**1,049**	**-**	**1,138**	**446**
2007	**2,085**	**782**	**-**	**869**	**333**
2008	**1,498**	**581**	**-**	**662**	**247**
2009	**1,073**	**430**	**-**	**502**	**183**
2010	**765**	**316**	**-**	**380**	**134**
2011	**544**	**232**	**-**	**286**	**99**
2012	**384**	**169**	**-**	**214**	**72**
2013	**270**	**122**	**-**	**160**	**52**
2014	**0**	**51**	**-**	**120**	**22**

PV @ earning rate	**11,318**	**3,913**	**0**	**4,282**	**1,664**

Note 2: The profit margin used for this projection is the profit margin for the current year's new business

You know that the earning rate for the assets of this business is 10% per annum, premium and initial expense cash flows occur at the beginning of the year, renewal expenses occur at the end of the year and claims are paid throughout the year. The profit carrier is claims.

You can ignore tax for all calculations in this question.

(a) Calculate the 31 December 2004 policy liability for the combined block of business. (2 marks)

(b) Determine the final 2004 profit margin percentage for the combined block of business. (1 mark)

(c) You have not yet finalised your valuation when you learn that the marketing department has devised a new campaign to attract new sales in 2005. It involves reducing the premium rates for this product by 20% for all policies (both 2004 in-force policies and 2005 new business) for the next year only. You are not considering any other changes to your valuation assumptions.

(i) Determine the revised final 2004 profit margin percentage for this business taking this change into account. (2 marks)

(ii) What are the implications if the targeted company profit margin (as a % of claims) for this type of business is 40%? (2 marks)

(iii) What would the implications be for both the current profits and expected future profits if it were decided that this 20% reduction was to apply to all future premiums? (2 marks)

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QUESTION 3 SOLUTION **(9 Marks)**

(a) Calculate the policy liability for the combined block of business.

Residual in force at end of year		New Business	
PVPrem	26,278	PVPrem	11,318
PV claims	9,282	PV claims	3,913
PVIE	0	PVIE	0
PVRE	10,659	PVRE	4,282
PVFPM	4,641	PVFPM	1,664
BEL	-6,337	BEL	-3,123
PVFPM	4,641	PVFPM	1,664
PL	-1,696	PL	-1,459

PL = -3,155

1 mark for correct calculation method, 0.5 mark for each individual PL, 0.5 mark for total PL, total of 2 marks.

(b) Determine the new profit margin for the combined block of business.

Combined PVFPM	= 6,305
Combined PV Claims	= 13,195
PM%	= 47.78%

1 mark

(c)

(i)

BEL before change	-9,460
PVFPM before change	6,305
PL	-3,155
Impact on BEL of 20% reduction in 2005 premium	+2,252
BEL after change	-7,208
adjusted PVFPM	4,053
PV Claims	13,195
new PM %	30.72%

0.5 mark for correct alteration to premiums and for not altering the expense columns. 0.5 mark for re-equating the PL's. 0.5 mark for recalculation of PVFPM. 0.5 mark for correct answer. Total of 2 marks.

(ii) The issue here is that the PM (%) is now lower than the minimum profit margin (provided the student has ended up with a lower % in part i), above).

The consequence of this change is, therefore, that this business is effectively returning a rate below the company's target. This means that the product is not returning adequate profit to the shareholders.

To allow this change to be made there would have to be sufficient profit arising out of the additional sales in 2005 expected to be generated (or improvements in experience for the in-force business) to cover the shortfall from this product, which would be difficult if priced to be competitive in the market.

1 mark for comparison between new PM and target PM and for identifying consequences of change (i.e. fail to meet profitability target). 1 mark for taking into account profit generated from other business. Total of 2 marks.

Note: If the student ended up with a PM% above 40% in (i), comments to the effect that the product is able to return the desired rate to shareholders even with the change should earn marks.

(iii) The profit situation would look as follows:

Impact on BEL of 20% reduction in all future premiums	+7519
BEL after change	-1,941
adjusted PVFPM	-1,214
new PM %	0

This change would result in the product moving into a loss recognition situation and the PV of the loss (1,214) would have to be taken into the accounts in the current year.

There would be no future profit expected from this business. Any future experience deviations would result in a profit if favourable or a loss if unfavourable in the year in which they occur.

1 Mark for the calculations. 1 Mark for discussion of loss recognition. Total of 2 Marks.

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QUESTION 4 **(25 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a) i)	2	5			5
Part a) ii)	2		2		2
Part a) iii)	2		2		2
Part a) iv)	2	1			1
Part b)	2, 3, 4			15	15
Total		6	4	15	25

Question

You are an actuary in the valuation department of MENO, an Australian Life insurance company. You have been asked to determine the Solvency Requirement for their Statutory Fund No.1 (SF 1) which has only two related product groups, Yearly Renewable Term (YRT) insurance and non-participating Whole of Life (WOL) assurance.

You have been provided with the following end of year information for MENO's Statutory Fund No.1. All numbers are in $m.

	SF 1		
	YRT	WOL	Total
POLICY LIABILITIES			
BEL	**(3,299)**	**4,121**	**822**
PVFP	**2,711**	**498**	**3,209**
PL	**(588)**	**4,619**	**4,031**
OTHER LIABILITY INFORMATION			
Solvency Liability	**(2,756)**	**4,221**	**1,465**
Solvency Liability (after adjusting for resilience reserve yield changes)	**(2,632)**	**4,010**	**1,378**
Minimum Termination Value	**152**	**3,320**	**3,472**
Current Termination Value	**152**	**3,897**	**4,049**
BALANCE SHEET			
Assets			
Cash			**885**
Accounts Receivable			**90**
Future Income Tax Benefit			**20**
Australian Government Bonds			**2,759**
Listed Equities[1]			**1,558**
Subtotal Assets			**5,312**
Liabilities			
Policy Liabilities	**(588)**	**4,619**	**4,031**

Accounts Payable	**250**
Provisions	**200**
Subtotal Liabilities	**4,481**
Equity	
Share Capital	**100**
Retained Profits	**731**
Subtotal Equity	**831**

PROFIT AND LOSS STATEMENT

Premiums	**2,225**
Investment Income	**487**
Claims	**(1,001)**
Expenses	
- acquisition commission	**(362)**
- other acquisition expenses	**(374)**
- maintenance commission	**(390)**
- other maintenance expenses	**(969)**
Change in Policy Liabilities	**607**
Profit (pre Tax)	**223**

Notes:

1. **The listed equities include a holding of $280m in AXP Ltd. The remainder of the listed equity investments are across a wide range of companies.**
2. **There are no related party assets or assets dependent on the conduct of business.**

(a) Section 6, paragraph 6.1 of AS2.03 outlines 9 steps in the calculation of the Solvency Requirement. For MENO's Statutory Fund No.1:

(i) Complete the steps a) through to f) of the Solvency Requirement calculation. (5 marks)

(ii) Calculate the Inadmissible Assets Reserve. (2 marks)

(iii) Calculate the Resilience Reserve. You may assume that A' equals 0.93 * A for your calculations and that other (non-policy) liabilities are unchanged under the resilience scenario. (2 marks)

(iv) Calculate the total Solvency Requirement. (1 mark)

(b) MENO needs to increase the amount of excess assets above its Solvency Requirement for Statutory Fund 1. Suggest possible actions that MENO might consider to achieve this. Explain how each of your suggested actions will increase the excess assets and outline any other business impacts that would arise. (15 marks)

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QUESTION 4 SOLUTION **(26 Marks)**

(a)

(i) Base liabilities

Step a) Get Solvency Liabilities
YRT solvency liability = -2,756
WOL solvency liability = 4,221

Step b) Get MTV's

YRT MTV = 152
WOL MTV = 3,320

Step c) Apply min of MTV at RPG level and aggregate

YRT MTV = 152
WOL SL = 4,221
Sum = 4,373

1 mark for steps a) to c)

Step d) Calculate & Add Expense Reserve

Expense Reserve = 70% of fixed acquisition expenses (note offset statutory capital has been ignored, if the student allows for it here then there would be an offset in the MCR)

= 70% * 374
= 262

Running total = 262 + 4,373 = 4,635

1 mark for step d)

Step e) Min of CTV

Total CTV = 4,049
Running total = 4,635

CTV minimum does not apply. Running total remains unchanged.

1 mark for step e)

Step f) Add Other Liabilities

Other liabilities = 450

Running total (i.e. L) after step f) = 5,085

1 mark for calculating other liabilities.
1 mark for the running total.

(ii) Inadmissible Assets Reserve

Only one asset is of definite concern, the investment in AXP, which exceeds 5% of the total statutory fund assets. The FITB may or not be classified as inadmissible (candidates should state their position). Therefore inadmissible assets reserve equals:

280 – 5% * 5,312 = 14.4m assuming FITB is admissible or
280 – 5% * 5,312 + 20 = 34.4m assuming FITB is inadmissible.

2 marks (0.5 mark penalty if candidates treat the FITB as admissible without stating their position)

(iii) Resilience Reserve

RR = L' * A / A' - L

We know A' / A = 0.93
Therefore A / A' = 1 / 0.93

L is from part i) = 5,085

L' needs to be calculated

For WOL L' = 4,010
For YRT L' = 152 (i.e. MTV doesn't change)
Other liabilities = 450
Expense Reserve = 262

Therefore total L' = 4,874

RR = 4,874 / 0.93 – 5,085 = 156

2 marks for calculation of RR

(iv) Solvency Requirement is sum of parts (i) to (iii):

5,085 + 14.4+ 156 = 5,255 assuming FITB is admissible or
5,085 + 34.4+ 156 = 5,275 assuming FITB is inadmissible.

Note this is greater than policy and other liabilities of 4,481.

0.5 marks for summation and 0.5 marks for check against PLs. (1 mark)

(b)

The actions to increase excess assets have been grouped into methods that reduce the solvency requirement and other methods.

ACTIONS TO REDUCE SOLVENCY REQUIREMENT:

- **Reinsurance**

  Explanation:
  This will further reduce the net solvency liabilities and termination values. There is also likely to be a subsequent reduction in the resilience reserve.

  Other Business Impacts:
  Reinsurance usually comes at a cost. This will mean lower future profits for MENO provided the underlying business is profitable.

- **Reduction in the other liabilities**

  Explanation:
  The other liabilities are currently quite large and the resilience reserve on this amount alone is 450 * (1/.93-1) = $34m.

  Other Business Impacts:
  A reduction in other liabilities is likely to lead to a reduction in cash assets (assuming no other changes). This may impact MENO's short term liquidity as well as having a further impact on the resilience reserve via the changed asset mix.

- **Sell some of the holdings in AXP Ltd**

  Explanation:
  This holding has caused a $14.4m inadmissible assets reserve. Maybe a small part of the holding could be sold to the Shareholders' Fund or another stat fund.

  Other Business Impacts:
  If the holding is sold to another part of the business then there will be little business impact overall. If the shares are sold to external parties then this may impact future profitability of the business (depending upon the relative performance of the replacement assets) as well as having impact on the tax position.

- **Utilise Offset statutory capital**

  Explanation:
  This would reduce the solvency requirement by reducing the expense reserve.

  Other Business Impacts:
  This would cause an increase in the management capital requirement in the shareholders' fund.

- **Improve the asset liability match**

  Explanation:
  Since there is currently a large resilience reserve, it is possible a more efficient asset liability match could be determined.

  Other Business Impacts:
  It is difficult to be specific from the information given. However a change in asset mix will change the expected future investment earnings and thus change the profitability of the business.

OTHER ACTIONS:

- **Use Subordinated debt**

  Explanation:
  Subordinated debt is not included in other liabilities when calculating the solvency requirement. Hence raising subordinated debt will increase the total assets without any offsetting impact on the solvency requirement. Assets in excess of the solvency requirement would increase.

  Other Business Impacts:
  Interest (or the like) will be payable on the subordinated debt. This could potentially reduce the profitability of the business if the subordinated debt costs exceed the investment earnings on the assets corresponding to the debt.

- **Increase Shareholder Capital**

  Explanation:
  This would increase the total assets of the fund, with no impact on the solvency requirement. Assets in excess of the solvency requirement would increase.

  Other Business Impacts:
  There is little overall business impact if it is simply a case of transferring capital from another part of MENO (e.g. another statutory fund). If new capital has to be raised from external sources then this may dilute earnings per share etc.

  0.5 mark for each method, 1 mark for explanation and 1 mark for other business impact. 2.5 marks in total for each point. 15 marks in total for part (b).

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QUESTION 5 **(22 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	6	1			1
Part (b)	6	3			3
Part (c)	6		4		4
Part (d)	8, 9, 12		4		4
Part (e)	Course A, 5			4	4
Part (f)	12			6	6
Total		4	8	10	22

Question

You work in the actuarial department of Retirement Inc, a life insurance company specialising in annuities. You have been valuing a block of annuity business written since the start of 2001. The following table shows the actual results calculated for 2003 and the expected results for 2004 (on the 2003 basis).

All numbers are in $'000.

Year	Premium boy	Annuity payments eoy	Commut-ations eoy	Initial Expenses boy	Renewal Expenses eoy	Planned Profits eoy	Policy liability eoy	Total Assets eoy	Investment income (total) eoy
2003							**1,176,052**	**1,216,262**	
2004	**0**	**100,527**	**157**	**0**	**3,519**	**20,508**	**1,127,783**	**1,167,382**	**79,057**

Note: boy is an abbreviation for beginning of year, eoy for end of year.

The profit carrier is annuity payments.

Assume all actual cash flows occur with the same timing as expected cash flows.

For the prior three years (i.e. 2001 to 2003) experience was exactly as expected.

For 2004 there was no new business and the following actual results were recorded:

Item	$'000
Annuity payments	**100,803**
Commutations	**157**
Renewal Expenses	**9,526**
Investment Income (total)	**78,944**

The actual investment earning rate was 6.5%.

The actual policy liability at the end of 2004 is 1,130,879. The difference between the expected and the actual policy liability at the end of the year is purely the result of more annuitants being alive than expected.

(a) Calculate the operating profit for 2004. (1 mark)

(b) Calculate the planned profits, total experience profit/loss and any other components of operating profit for 2004. (3 marks)

(c) Assuming all cash flows occur at the end of the year, determine the following:

(i) The experience profit/loss due to investment/economic conditions. (1 mark)

(ii) The experience profit/loss due to maintenance expenses. (1 mark)

(iii) The experience profit/loss due to mortality experience. (2 marks)

(d) You have been asked to provide a commentary on these results for inclusion in the Financial Condition Report. Please draft your comments for the appointed actuary. (4 marks)

(e) Given the experience results for this product you have been allocated one of the actuarial analysts to assist you in performing your investigation into the expense experience. The aim of this investigation is to determine the causes of the deterioration in results. Please provide the analyst with a list of things that need to be investigated together with reasons why. (4 marks)

(f) Following this investigation you have determined that there are permanent changes to the business that need to be reflected by strengthening the basis. You have decided that the renewal expense assumption needs to be increased.

The Managing Director (MD) is upset with your change as this has caused a $15m reduction in the present value of future profits. He has suggested that:

- **any changes to the valuation basis cannot be justified on the results of 1 year;**
- **the company should be able to move gradually into taking these changes into account and thus should not have to wear the difference now;**
- **he is sure that the expense situation can be brought back in line with expectations within the next year or two.**

He has therefore suggested that the basis should not change this year and that the experience should be monitored for another year to give him a chance to consider ways to reduce the expense levels first.

Draft your response to the MD covering the following:

- **the professional issues involved in complying with the MD's request;**
- **the impact your assumption change will have on current period financial statements;**
- **the impact of the assumption change on actual future profits that will be earned if the MD is able to reduce expenses to their previous levels.**

(6 marks)

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QUESTION 5 SOLUTION **(22Marks)**

(a) The operating profit is:

	$'000
Cash flow	(31,542)
Plus release of starting reserve	1,176,052
Less set up of end reserve	(1,130,879)
Profit	13,631

1 mark

(b)

The analysis is:

Earnings on assets in excess of PL is calculated as 6.5% * (1,216,262 – 1,176,052)

Item	$'000
Planned profit	20,508
Experience profit	(9,491)
Earnings on assets in excess of PL	2,614
MoS profit	13,631

Experience profit is actual cash flow less expected cash flow plus actual end year reserve less expected end year reserve (as reserve change due to mortality experience).

1 mark for planned profit, 1 for experience profit and 1 for interest term to a maximum of 3 Marks. (KU)

(c)

(i) Actual investment earnings less expected
= 78,944 - 79,057 = (113) 1 mark

(ii) Actual expenses less expected
= (9,526) + 3519 = (6,007) 1 mark

(iii) Actual payments less expected + actual reserve less expected
= (100,803) + 100,527 – 1,130,879 + 1,127,783 = (3,372) 2 marks

(d) It can be seen from these results that the profit this year has been significantly reduced by some adverse experience.

The largest effect has been the result of a significant expense experience loss. A small portion of this would be due to the increase in the number of annuitants and their associated payments. However, there is a significant and unexplained increase.

We have also suffered poor experience in longevity, with significantly more people living to the end of this year than were anticipated. This has also had a negative effect on this year's profit.

The actual investment earnings were very close to expected and this was not a significant component of the overall experience loss.

1 mark for each point, to a maximum of 4 marks.

(e)

Investigation item		Reason
Expenses		
	Check the payments process	To ensure no breakdowns in procedure that have led to expensive work-arounds or manual intervention
	Check the expense apportionment from the current year and compare to previous years	To identify if any areas have changed their split up of expenses and this has resulted in more being attributed to this product than there should be.
	Check for one-off expenses	To identify any unusual and non-recurring items that may affect the accounts.
	Check the non-apportioned expense data	To make sure no large/repetitive entries have been put through to this product by mistake
	Comparison of Actual to Budget	Highlight any areas of differences
	Reconcile projected expense results	Are there any errors in the expense treatment within the valuation system

0.5 mark for each investigation, 0.5 mark for each reason, to a maximum of 4.

(f) Dear MD,

For some assumptions (e.g. mortality) it is usual to look at a number of years of experience, rather than basing an assumption change on one year's experience. However the size of the deterioration in the expense position that has occurred is too large to be ignored.

AS1.03 requires the renewal expense assumptions to be sufficient to cover the expected costs in the next year. There are currently no established and agreed plans for reducing unit costs, hence in the absence of other information it would be remiss of me to not reflect the deterioration in expenses in my best estimate assumptions.

Given that the assumption affected is expenses it is unlikely that the change will be a one off. It is more likely that this change reflects a significant change in the administration of the business. Therefore ignoring this change given general knowledge of the nature of expense patterns would put the actuary at risk of professional negligence, in particular non-compliance with AS1.03.

Adjusting the assumptions over a number of years would be counter to sound actuarial practice and inconsistent with the requirement (in AS1.03) for me to use best estimate assumptions.

You should also be aware that the assumption change does not impact the current period profit, as the total policy liability is unchanged. However it will impact the split of the policy liability into best estimate liability and present value of future profits.

The expense assumption change does not necessarily impact future profits, although it does reduce future planned profits. If you are able to reduce expenses back to their previous levels then future profits will not be impacted as (ignoring future assumption changes) we will earn future experience profits in each period to offset the reduction in planned profits.

2 marks for discussion of professional issues. 2 marks for discussion of current financial statement effects. 2 marks for impact on future profits assuming expenses decrease. Maximum of 6 marks.

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QUESTION 6 **(15 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a) i)	7, 9		2		2
Part a) ii)	7, 9			3	3
Part a) iii)	7, 9			7	7
Part b)	5, 7, 9			3	3
Total			2	13	15

Question

You are an Australian consulting actuary who has been asked to provide advice to ETERNAL, a small life insurance company operating in the country of Moldovia.

ETERNAL has just one Statutory Fund from which they only sell profitable single premium investment-linked business. You have been provided with the following information about ETERNAL's only investment linked product:

Product Information:
- **Entry Fee: Nil**
- **Exit Fees: 3% in year 1, 2% in year 2, 1% in year 3 and 0% thereafter**
- **Ongoing Fees: 2.5% of Account Balance**

Expense Levels:
- **Acquisition Expenses (including commission): 8% of Premium**
- **Maintenance Expenses (including commission): 1% of Account Balance**

Asset Information:
- **ETERNAL's Statutory Fund investments include four unlisted companies (including an IT company and a finance company that both have low net assets relative to their net market value). Each of these companies is very profitable and together they account for about 30% of the current value of total assets.**
- **The balance of assets is a mixture of listed shares, commonly traded debt securities and cash investments.**

The Insurance Regulator of Moldovia is thinking of changing its financial reporting regime in relation to life insurance business. Its current regulatory and financial reporting regime is identical to Australia's at 1 January 2004. The financial reporting changes being considered by the Regulator are as follows:

Area of regulation:	Current situation	Proposed situation
Valuation of Assets (Life Insurance Companies)	All life insurer's assets are valued at net (of realisation costs) market value in their balance sheet.	The value of unlisted subsidiary companies owned by life insurers cannot exceed the net assets

		of the subsidiary. Other assets will be valued at current market value.
Expense treatment of investment linked contracts	**For profitable business, acquisition costs are currently able to be fully deferred and offset against future revenues.**	**Only 50% of acquisition costs will be able to be deferred and offset against future revenues.**
Surrender Value Floor	**N/A.**	**The policy liability (at the related product group) for investment linked policies cannot be less than the current surrender value.**

(a) You have been asked to provide a report to the Board of ETERNAL answering the following questions:

(i) What impact will the asset valuation changes have on the value of assets, as reported in the financial reports to the Regulator? (2 marks)

(ii) What impact will the change in expense treatment have on the pattern of operating profits and total operating profits for this business, as reported in the financial reports to the Regulator? (3 marks)

(iii) What additional impacts will the introduction of the surrender value floor (in addition to the expense changes) have on the pattern of operating profits and total operating profits for this business? (7 marks)

(b) What product changes could the company consider to reduce the impact of the proposed financial reporting changes on operating profits? State the reasoning behind your suggested changes. (3 marks)

Draft your report.

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QUESTION 6 SOLUTION **(15 Marks)**

(a)

1 mark penalty for failing to use report format deduct from Part (i) marks.

Report into a potential change of regulatory basis May 2005

Report to: Board of ETERNAL

Report by: A N Actuary

Report date: 17th May 2005

Purpose

The purpose of this report is to identify the effect that the changes proposed in the document provided to me will have on life insurance companies in Moldovia and their owners.

(i) Impact of changes in asset valuations

The changes in the asset valuation rules will impact ETERNAL's value of assets in two different ways:

- The value of the unlisted subsidiaries will decrease as their current net market values exceed their net assets. This will reduce the total assets.
- The value of other assets should increase, as their values will no longer be net of realisation costs.

1 mark per valid point. Maximum 2 marks

(ii) Changes in acquisition expense deferral

As Eternal's investment linked business is profitable, all acquisition expenses are deferred such that there is no profit or loss at issue under the current reporting requirements. The regulator is proposing to allow only 50% of acquisition expenses to be deferred (rather than the current 100%). The consequences of this are as follows:

- The pattern of profits over the life of the policy will change. There will be a loss at issue (due to not being able to defer all acquisition costs).

  Explanation: Previously the policy liability at issue would be 92% (=100% - 8% * 100%) of premium, such that there is no profit or loss at issue. The policy liability at issue will now become 96% (= 100% - 8% * 50%) of

premium. The loss at issue will be equal to 4% of premium, which is the amount of non-deferable acquisition expenses.

This loss at issue will be offset by higher profits in future years (as there will be lower ongoing amortisation of deferred acquisition costs). (2 marks)

- This change will not change the expected total operating profits over the life of a policy, it will merely change the pattern of profit emergence (1 mark)

3 marks Note not all the explanation is required for the marks but helps explain answer in next section.

(iii) Application of surrender value floor

As described above, the acquisition expense deferral changes will cause a loss at issue followed by higher operating profits in subsequent years. The additional impacts from applying the surrender value floor are as follows:

- The application of the surrender value floor will exacerbate the loss at issue as it will effectively allow for an even lower level of expense deferral. (2 marks)

  Explanation: Prior to the SV floor the policy liability at issue was 96% (= 100% - 8% * 50%) of premium. However the SV floor would mean that the PL could not be less than 97% of premium, causing an additional 1% strain at issue.

- Effectively no DAC will be able to be recognised in years 4+, as the current termination value equals the account balance. Thus there will be no DAC amortisation after year 4, this should give higher profits for these later years under the proposed basis. (2 marks)

- Profits for years 1 (after issue) to year 3 will be impacted by offsetting effects. Firstly there will be a smaller starting amount of DAC to be amortised, however this smaller DAC will be amortised over a short period, thus increasing the amortisation each year. The operating profits may be broadly similar to that under the current basis, however we would need to undertake further calculations to confirm. (2 marks)

- This change will not change the expected total operating profits over the life of a policy, it will merely change the pattern of profit emergence. (1 mark)

  7 marks

(b)

The company could consider the following product changes:

- Introduce an entry fee - The entry fee would be offset against acquisition expenses at issue to give a smaller DAC. Thus the changes to DAC recognition and SV floor (which effectively accelerates DAC amortisation) will have less effect as they are applied to a smaller number. Also the introduction of an entry fee would result in greater matching of revenue and expenses, thereby improving operating profit.

- Change commission terms by increasing trail commission and decreasing initial commission. This would give a smaller DAC at issue and thus reduce the impact of the changes as described above.

- Increase the exit fee period (say to 5 or even 7 years). This would reduce the impact the SV floor has on effectively accelerating the DAC amortisation as described above.

- Increase exit fee rates - this would negate the impact of the surrender value floor minimum, as it would be less than the policy liability.

  0.5 mark for each change and 0.5 mark for reasoning provided with each change. Maximum of 3 marks.

END OF PAPER