INSTITUTE OF ACTUARIES OF AUSTRALIA

LIFE INSURANCE PART B **NOVEMBER 2005 EXAMINATIONS**

MARKING GUIDE

Level of Difficulty

PAPER ONE

Question	Syllabus Aims	Units	Knowledge & Understanding	Straight forward judgement	Complex judgement	Total marks
1a	3, 10	2, 5		3		3
1b	1, 2	1		4		4
1c (i)	1, 2, 3	1, 2	1			1
1c (ii)	1, 2, 3	1, 2	2			2
1c (iii)	1, 2, 3, 6, 7	1, 2, 3	1			1
2a	10	5	7	4		11
2b (i)	4	2			2	2
2b (ii)	11	5			3	3
2c	11	5		3		3
3a (i)	2	1	4			4
3a (ii)	4	2	4			4
3b (i)	1, 2, 5, 13	1, 2, 6			4	4
3b (ii)	4, 5, 11, 13	2, 5, 6			5	5
4a	1, 2	1		4		4
4b (i)	1,2, 4	1, 2			3	3
4b (ii)	1,2, 4	1, 2			3	3
4c (i)	1,2, 4	1, 2		3		3
4c (ii)	1,2, 4	1, 2		1		1
4c (iii)	1,2, 4	1, 2		2		2
5a	6	3			5	5
5b (i)	6	3		6		6
5b (ii)	5, 6, 8, 12	2, 3, 4, 6			6	6
6a	1, 6	1, 3	3			3
6b	4	2		7		7
6c	4, 6	2, 3			10	10
TOTAL			22	37	41	100

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QUESTION 1 **(11 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	3, 10		3		3
Part (b)	1, 2		4		4
Part (c) (i)	1, 2, 3	1			1
Part (c) (ii)	1, 2, 3	2			2
Part (c) (iii)	1, 2, 3, 6, 7	1			1
Total		4	7		11

Question

You are the valuation actuary for a medium sized UK life insurance company owned by a large Australian funds management company. You report to your parent under Australian legislation, guidelines and standards. Your team has recently completed the Margin on Services (MoS) valuation results for the financial year ended 30 June 2005.

The Chief Financial Officer (CFO) has asked you to provide him with some preliminary information regarding the earnings performance and the corresponding valuation interest rate used on your large block of annuity business. The assets backing the annuity business have always been fixed interest securities. This product has been closed to new business for 2 years.

The investigations provided to you by your staff are:

Year ending 30 June	1999	2000	2001	2002	2003	2004	2005
Actual earned rate	6.70%	6.80%	6.90%	9.20%	7.10%	7.20%	7.50%
Benchmark earned rate	6.60%	6.60%	6.75%	7.00%	6.80%	6.80%	7.00%
Risk free rate	5.10%	5.20%	5.30%	5.50%	5.30%	5.40%	5.60%

The valuation investment earnings rate assumption for this product, whilst reviewed annually, has remained the same at 6.90% since 30 June 1999.

General economic commentary indicates that interest rates are expected to remain stable for the medium term due to the low level of economic growth being experienced globally.

While the duration of liabilities is greater than the duration of assets, the investment team has actively managed the portfolio to improve the matched position (increasing exposure to longer term fixed interest securities). It has also been improving the yield and credit risk profiles of the securities held, at low cost to the fund.

For your reply to the CFO, discuss the following points:

(a) What are the benefits of improving your matched position? (3 marks)

(b) Discuss your views on increasing the valuation investment earnings rate assumption for the valuation at 30 June 2005 and recommend an appropriate rate.

(4 marks)

(c) Having concluded that you will increase your valuation investment earnings rate assumption at 30 June 2005, discuss the effect this change would have on the:

(i) Best Estimate Liability; (1 mark)

(ii) Policy Liability; and (2 marks)

(iii) Profit Margin. (1 mark)

QUESTION 1: SOLUTION **(11 Marks)**

(a) The benefits are:

- Reduces your resilience reserve requirement and the capital required to support the fund;
- Reduces profit volatility / more predictable profits;
- Allows a lower discount rate to be used when calculating an Appraisal Value as the risk is reduced.

Marking guide:
- 1 mark for each valid point.
Maximum of 3 marks (SJ).

(b) As per AS 1.03, the best estimate assumption for investment earnings must reflect the expected investment earnings applicable to the assets backing the benefits being valued. As per GN *259*, in determining the average expected investment earnings rate assumption, appropriate allowance needs to be made for credit and default risks, changes in asset mix and the outlook for reinvestment rates.

For this annuity portfolio, the best estimate earnings rate assumption should be determined based on the yields of the underlying fixed interest assets backing the policy liability. However, we have only been given historical information on earnings rates and need to determine an appropriate assumption based on the information been given.

The valuation discount rate was last set 6 years ago. The earned rate at that time was 6.70% and the assumption was set at 6.90%. This indicates that the long term return on the portfolio was expected to be 6.90% on average.

Both the risk free rate and the benchmark rate have been gradually increasing over time and the earned rate of the fund has been at least 6.90% over the last *5* years, with an average return of 7.34%. In recent years, the actual earned rate has been higher than in the past and consistently above the benchmark.

The active management of the portfolio to improve the matched position, combined with the stable economic outlook, indicate that the current return should stabilise or increase slightly in the medium term.

Based on the information given, it is therefore considered appropriate that the valuation discount rate used for the fund be increased to 7.10— 7.20%. This gives a margin for fluctuations above the most recent earned rate and takes long term expectations into account.

Marking guide

- 1 mark for explaining best estimate assumption and underlying asset yield;
- 1 mark for increasing returns over 7 years;
- 1 mark for active management and economic outlook and likely future performance;
- 1 mark for recommending an appropriate rate.

Alternatively, some candidates may argue that a risk free rate might be more appropriate. Provided a well presented case is presented award appropriate marks.

Total of 4 marks (SJ).

(c)

(i) Future cash flows will now be discounted at a higher rate, thus decreasing the BEL (which should be positive, as this is an annuity portfolio closed to new business).

Marking guide:
- 1 mark (KU).

(ii) As the assumption change is primarily driven by general economic conditions (benchmark rate going up), this change will result in a new policy liability. An increase in the valuation discount rate assumption will reduce the policy liability.

Marking guide:
- 1 mark for recognising economic assumptions and change to PL;
- 1 mark for direction of change.

Total of 2 marks (KU).

(iii) The profit margin will remain unchanged. Future profit cashflows will therefore remain the same, they'll just be discounted at a higher rate so PV of profit will drop.

Marking guide:
- 1 mark (KU).

QUESTION 2 **(19 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	10	7	4		11
Part (b) (i)	4			2	2
Part (b) (ii)	11			3	3
Part (c)	11		3		3
Total		7	7	5	19

Question

You are an actuary working for DEF Funds Management of Australia. Your company is the wholly owned subsidiary of an overseas parent.

Your parent wishes to expand its Australian operation and is negotiating the purchase of UVW, an Australian life insurance company. UVW has a large block of participating traditional business and is about to launch a single premium investment-linked savings product. The traditional product is closed to new business.

You have been asked to assist with the calculation of UVW's appraisal value (from the perspective of DEF's parent).

(a) The Appointed Actuary (of DEF) has decided that the method to be used to determine the value of new business is the present value of net of tax shareholder cash flows. The following assumptions are to be used:

Policy term:	**5 years**
Capital:	**12% of account balance**
Annual management fee:	**4% of account balance**
Expenses:	**1.5% of account balance**
Investment earnings rate:	**8% p.a. (earned in advance)**
Tax:	**30% of profit**
Discount rate:	**13.5% p.a.**
New business growth rate:	**10% p.a.**

All cash flows occur at the start of the year. The total account balance for the business sold in the first year ($m) is expected to be as follows:

Year (soy)	1	2	3	4	5
Balance ($m)	10.000	8.250	6.806	5.615	4.633

Note: soy means start of year.

Calculate the value of future new business (i.e. all future years). (11 marks)

(b) For the following assumptions, discuss whether you think the values given are appropriate for this product. Suggest any changes you would make and the impact they would have on the value of new business.

(i) Capital (2 marks)

(ii) New Business Growth Rate (3 marks)

(c) This acquisition is still being discussed over the financial year end of UVW. The year end figures provided by the company have been relied on for the calculation of the appraisal value (AV).

Subsequent to the year end, a 10% fall has occurred on the Australian share market, where 65% of the company's assets backing its liabilities are held. For the traditional portfolio this has resulted in a 6.5% ($2.47m) reduction in the value of assets backing liabilities.

How would this change be reflected in the AV of the traditional portfolio? (3 marks)

QUESTION 2: SOLUTION **(19 Marks)**

(a)

Projection of 1 year's new business will look like:

Start of Year	1	2	3	4	5	6
Account balance	10.000	8.250	6.806	5.615	4.633	0
Capital	1.200	0.990	0.817	0.674	0.556	0.000
Investment Earnings on Capital	0.096	0.079	0.065	0.054	0.044	0.000
Fees - Expenses	0.250	0.206	0.170	0.140	0.116	0.000
Gross Profit (soy)	**0.346**	**0.285**	**0.235**	**0.194**	**0.160**	**0.000**
Tax	0.104	0.086	0.071	0.058	0.048	0.000
Increase in Capital	1.200	0.210	0.173	0.143	0.118	0.556
Net cashflow	**-0.958**	**0.410**	**0.338**	**0.279**	**0.230**	**0.556**

Discounting the net cash flows at 13.5% gives a PV of \$0.290m.

PV of net cashflows arising from sales in the second year is .290 * (1.1 / 1.135)
PV of net cashflows arising from sales in the third year is .290 * $(1.1 / 1.135)^2$
……. etc.

This is a geometric series that can be evaluated by:

.290/ (1-(1.1/1.135)) = \$9.414m

Note that imputation credits are not relevant as the purchaser is a foreign company.

Marking guide:
- 1 mark for capital (KU);
- 1 mark for interest on capital (KU);
- 1 mark for fees less expenses (KU);
- 1 mark for profit (KU);
- 1 mark for tax (KU);
- 2 marks for correct net cash flow all years (SJ);
- 1 mark for PV cash flow (KU);
- 2 mark for perpetuity (or similar) method of calculation and final answer (SJ);
- 1 mark for correct handling of imputation credits and stating their irrelevance (KU).

Total of 11 marks.

Marking Note: Some candidates may use a multiple approach of 1 year's profit e.g. 15. Provided they provide some commentary regarding their choice then award the full two marks allocated to this calculation.

(b)

(i) The capital assumption seems far too high for an investment-linked product and is unlikely to be anywhere near 12% of the account balance. There may be a small margin for being investment-linked business (if capital adequacy liability is greater than the MTV – although this is unlikely). An amount of 1% may be more appropriate.

A lower amount of capital will result in a higher value of new business.

Marking guide:
- 1 mark for lower capital including a suggested level;
- 1 mark for increased value of new business.

Maximum of 2 marks (CJ).

(ii) The investment-linked product market is not limited to life insurance companies and includes unit trusts and master trusts as well.

Both of these factors will result in a very competitive environment, in which a growth rate of 10% is unlikely to be sustainable over the long run.

An appropriate assumption would therefore be a decreasing growth rate where the long run value is related to the expected growth of the market as a whole (e.g. economic forecasts of GDP).

Alternatively it may be more appropriate to consider the prospective life cycle of the product and consider how many years of sales may be achievable.
A change to this assumption (to decrease the growth rate) will result in a lower value of new business.

Marking guide:
- 1 mark for homogenous product and competitive environment;
- 1 mark for lower growth rate appropriate;
- 1 mark for decreasing shape and long-run value;
- ½ mark for any other relevant comments.

Maximum of 3 marks (CJ).

(c)

The overall effect is to reduce the AV by up to $2.47m.

Equities are used to back the portfolio of traditional business, so at least part of the drop would be borne by the policyholders, as the company would reduce bonuses accordingly.

The remainder would be borne by shareholders and would have an impact on net worth, and hence the AV.

The deferred tax liability would also decrease (or alternatively the deferred tax asset would increase) for a one-off profit impact.

Marking guide:
- 1 mark for policyholder participation for traditional business – no impact on AV;
- 1 mark for shareholder participation – decrease in NW and AV;
- 1 mark for overall effect;
- ½ mark for DITL comment.

Maximum of 3 marks (SJ).

QUESTION 3 **(17 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a) (i)	2	4			4
Part (a) (ii)	4	4			4
Part (b) (i)	1, 2, 5, 13			4	4
Part (b) (ii)	4, 5, 11, 13			5	5
Total		8		9	17

Question

You are an actuary working for a large multi-national insurer based in Apica. Your company owns a number of life insurance subsidiaries. Your responsibilities cover Australia and a number of other countries. Each subsidiary is currently subject to the regulatory and reporting requirements of its country of residence. Several of the life insurance subsidiaries you are responsible for operate in highly competitive environments with little prudential supervision.

The life insurance regulator in Apica has announced the following proposed changes to the policy liability valuation and capital requirements.

	Proposed Approach
Policy Liability Valuation	**A requirement to use best estimate assumptions with a prudential margin.**
Capital Requirement	**Minimum capital requirement of $5m.** **A risk-based capital requirement, which is consistent with the company's risk profile and provides a buffer above the liability valuation.**

The proposed changes will apply for the parent company and all subsidiaries in the consolidated entity.

The Executive Committee has determined that this revised basis should also be used for all internal management reporting, with internal profit and capital benchmarks throughout the group based on this revised basis.

You have been asked to provide your advice, in the form of a memorandum to the Executive Committee, on each of the following aspects of the proposed approach:

(a) Compare the proposed approach to the existing approach applicable to the Australian subsidiary for the:

(i) policy liability valuation; (4 marks)

(ii) capital requirement. (4 marks)

(b) For the non-Australian subsidiaries you are responsible for, discuss the likely impacts of applying the proposed approach for the following:

(i) policy liability valuation; (4 marks)

(ii) capital requirement. (5 marks)

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QUESTION 3: SOLUTION (17 marks)

Memorandum

To: Executive Committee
From: A.N. Actuary

Date: 1st November 2005

Subject: Effect of implementing proposed valuation and capital management aproach

Thank you for asking me to provide comments on this subject. I have set out answers below in the format you have requested.

1 mark for appropriate language and format to be included in (a) (i).

(a)

(i) Policy Liability Valuation

A similar valuation standard already exists in Australia — AS 1.03.

The difference between AS 1.03 and the proposed approach is:

- AS 1.03 requires the use of best estimate assumptions to calculate the Best Estimate Liability and an explicit profit margin is used to calculate the PV of Profits, which is added to the BEL.
- The proposed approach requires the use of best estimate assumptions as only a starting point for deriving the valuation basis. The PV of profits is thus not explicitly quantified.
- The proposed approach makes no mention of loss recognition. Under AS 1.03 losses must be capitalised when identified.

Marking guide:
- 1 mark for AS 1.03;
- 1 mark for treatment of profit;
- 1 mark for loss recognition;
- ½ mark for any other relevant comments.

Maximum of 4 marks (KU).

(ii)

Capital Management

With regard to the minimum capital requirement, our Australian life company already has a minimum capital requirement of $10m. However, up to $5m of this minimum capital requirement can be used within the business to fund expense reserves, new business requirements and other reserves under the management capital standard.

In addition, Australian companies must comply with both Solvency (AS2.03) and Capital Adequacy (AS3.03) requirements that are quite stringent. Both of these standards have risk-based elements, such as resilience reserves, as a buffer against the company's exposure to adverse market movements.

Marking guide:
- 1 mark for minimum capital requirement of $10m;
- 1 mark for offset statutory capital;
- 1 mark for existing solvency & capital adequacy standards;
- 1 mark for explicit mention of resilience reserves and risk-based capital;
- ½ mark for any other relevant comments.

Maximum of 4 marks (KU).

(b)

(i) Policy Liability Valuation

- Change the pattern of profit recognition but will not change the total profit over the life of the business (just timing of release);
- May have some impact on pricing;
- Dual reporting basis — change in dual reporting, restating opening issues and associated practical issues;
- Potential one off hit (either way) in profit.

Marking guide:
- 2 marks for changing pattern of profit;
- 1 mark for impact on pricing;
- 1 mark for dual reporting basis;
- 1 mark for potential one off impact.

Maximum of 4 marks (CJ).

(ii) Capital Requirement

This is likely to increase capital requirements. If this was the case then:
- Additional strain to fund the higher requirement with the parent required to invest to meet this strain;
- Return on capital is likely to be lower;
- Price of products may have to increase to meet targeted profitability, which will result in less competitive products;
- Company will be better capitalised which would improve local ratings;
- EV/AV would decrease.

Marking guide:

- 1 mark for strain on parent company;
- 1 mark for lower return on capital;
- 1 mark for potentially reduced competitiveness in existing markets;
- 1 mark for ratings impact;
- 1 mark for impact on AV and share price.

Maximum of 5 marks (CJ).

QUESTION 4 **(16 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	1, 2		4		4
Part (b) (i)	1, 2, 4			3	3
Part (b) (ii)	1, 2, 4			3	3
Part (c) (i)	1, 2, 4		3		3
Part (c) (ii)	1, 2, 4		1		1
Part (c) (iii)	1, 2, 4		2		2
Total		0	10	6	16

Question

You are the valuation actuary for Protect It Life Insurance Company of Australia. Your company writes a range of business including a Disability Income product offering two alternative benefit types:

- **Policy A provides income for up to 2 years. At the end of the benefit period or when the insured resumes work, the policy remains in force and the insured can claim for any disability NOT related to previous claims.**

- **Policy B provides income to the insured up to the policy anniversary following their 65th birthday. If the insured resumes work, the policy remains in force and he/she can claim for any disability, i.e. the claim can relate to previous claims.**

One of your assistants has recently developed a computer model to calculate the reserves for this business. To check the reasonableness of the results of this model you have requested that calculations be performed for a policyholder aged 40 for Policy A and Policy B separately.

The model assumes that:

- **calculations are at policy inception;**
- **the profit carrier is claims;**
- **the profit margin is the same for both policies, with premiums set accordingly;**
- **premiums are paid annually in advance; and**
- **all other assumptions, except for second and subsequent claims, are the same for both policies.**

The model output for the best estimate liability (BEL) for each of these is below:

Benefit Term	BEL
2 Years	-8,526
To age 65	-14,289

(a) Explain why the BEL results differ and what the profit consequences are.
(4 marks)

(b) Satisfied that the model is accurate, you decide to review the assumptions used for the MoS valuation for these policies. For each of the following, comment on how and why your assumptions would differ between Policy A and Policy B:

(i) Termination rates (i.e. claim recovery rates); (3 marks)

(ii) Renewal expenses. (3 marks)

(c) Now consider the Solvency Requirement 6 months after policy inception. Discuss the differences in magnitude that you would expect Policy A and Policy B (for same age, sex, waiting period, occupation class) to contribute to each of the following:

(i) Minimum Termination Value; (3 marks)

(ii) Expense Reserve (ignore Offset Statutory Capital); (1 mark)

(iii) Resilience Reserve. (2 marks)

QUESTION 4: SOLUTION (16 marks)

(a) The policy liability should be 0 at inception for both policies, comprising a BEL and present value of profit margins.

The longer benefit period for policy B means that the expected claims are higher for the lifetime of the policy. This means that PV Claims is also higher.

As claims is the profit carrier, the PVPM is higher on policy B.

Therefore the BEL is negative for both policies, but it is more negative for Policy B due to higher expected profits.

Algebraically this can be more easily explained as follows:

$\frac{PVPM_A}{PVClaims_A} = \frac{PVPM_B}{PVClaims_B}$ (Given that profit margins are the same)

As $PVClaims_A < PVClaims_B$

Then $PVPM_A < PVPM_B$

As BEL at inception = -PVPM then

Then $BEL_A > BEL_B$

Marking guide:
- 1 mark for 0 PL at inception;
- 1 mark for higher claims for policy B;
- 1 mark for higher profits;
- 1 mark for final answer.

Maximum of 4 marks (SJ).

(b)

(i) Claims on Policy A are likely to receive less scrutiny than claims on Policy B. This is because the financial impact of potentially closing a claim is lower for Policy A since the claim is paid for a maximum of 2 years. This would imply higher termination rates for Policy B.

Claimants also have less incentive to terminate with Policy A since they cannot go back on claim once they resume work.

Hence the termination rates should be higher for Policy B.

Marking guide:
- 1 mark for more claims management for Policy B;
- 1 mark for more incentive to terminate for Policy B;
- 1 mark for final answer;
- ½ mark for other relevant comments.

Maximum of 3 marks (CJ).

(ii) Claims management expenses are going to be higher for Policy B due to the longer benefit period and higher impact of managing claims.

Investment expenses are also going to be higher due to a larger Open Claims Reserve and the higher costs of holding growth assets (held to provide some protection against inflation).

Hence the renewal expenses should be higher for Policy B.

Other maintenance expenses (administration, etc) should be no higher.

Marking guide:
- 1 mark for claims management expenses;
- 1 mark for investment expenses;
- 1 mark for other expenses;
- 1 mark for final answer.

Maximum of 3 marks (CJ).

(c)

(i) The MTV is the unearned premium (because there is no surrender value) and the open claim reserve.

One would expect the premium under policy B would be larger than policy A for the same benefit, age, sex, occupation and waiting period given the longer benefit period. (This is also indicated by Policy B having higher expected claims, yet its BEL is lower than Policy A, meaning that premiums are significantly higher for policy B.) Hence, the unearned premium reserve would be higher.

The open claims reserve would also be much larger for Policy B than A given the benefit period is to age 65.

Hence MTV is higher for Policy B.

Marking guide:
- 1 mark for MTV being unearned premium + open claims reserve;
- 1 mark for higher premiums for Policy B;
- 1 mark for higher open claims reserve for policy B.

Maximum of 3 marks (SJ).

(ii) The Expense Reserve is defined as non-commission fixed acquisition expenses (after tax) over the last 12 months.

Theoretically, Policy B is likely to have marginally higher underwriting costs due to the longer benefit period. This is mainly a fixed expense because it cannot be easily eliminated.

Hence the Expense Reserve would be higher for policy B.

Note: Candidates arguing no material difference should receive full marks provided an appropriate explanation is provided.

Marking guide:
- 1 mark for Expense Reserve marginally higher for policy B.

Maximum of 1 mark (SJ).

(iii) The resilience reserve is based on the movement of assets and liabilities. Policy B has a potentially larger open claims reserve which is likely to be more volatile to changes in investment returns than a smaller reserve. This is particularly the case since the longer duration of the liabilities is harder to match with fixed interest securities and other asset classes, e.g. equities, may have to be held, increasing volatility and the resilience reserve.

Thus the resilience reserve is likely to be higher for Policy B than Policy A.

Marking guide:
- 1 mark for larger open claims reserve for Policy B;
- 1 mark for higher resilience reserve for Policy B.

Maximum of 2 marks (SJ).

QUESTION 5 **(17 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	6			5	5
Part (b) (i)	6		6		6
Part (b) (ii)	5, 6, 8, 12			6	6
Total			6	11	17

Question

You are a valuation actuary at Great Asia Life Insurance, a large life insurance company selling life insurance policies in Asia.

Great Asia has been very successful in selling participating Whole of Life business and has a very large block of open business.

Your analysis of profit results and other valuation information for this block of business are detailed below:

	$m
Analysis of profit	
Planned profit	**20,510**
Experience profit	**15,821**
Interest on retained earnings	**5,614**
MoS profit	**41,945**
Experience Profit	
Investment earnings	**10,758**
Surrenders	**5,063**
Valuation information	
Reversionary bonus rate on sum insured and bonuses	**4.00%**
Policyholder retained earnings (soy)	**14,069**
Shareholder retained earnings (soy)	**6,530**
Proposed policyholder distribution (at 4%)	**16,472**
Proposed shareholder distribution	**4,036**

Note: "soy" is beginning of year; "eoy" is end of year.

The regulatory and tax environment in which you operate is identical to Australia.

(a) Calculate the policyholders' and shareholders' retained earnings after the proposed distributions at the end of the year. (5 marks)

(b) Your marketing department has heard about these results and has suggested that a reversionary bonus rate of 8% be declared for both sum insured and existing bonuses.

(i) Identify and explain three main considerations for bonus distribution that apply in this situation. (6 marks)

(ii) Give your opinion, with reasons, as to whether the bonus rate should be increased as suggested. If the bonus rate is not increased, suggest alternative approaches. (6 marks)

QUESTION 5: SOLUTION **(17 marks)**

(a)

	policyholders	shareholders
Planned profit (split 80/20)	16,408	4,102
Experience profit (split 80/20)	12,657	3,164
Return on retained profits (split in proportion to retained profits at start of year)	3,834	1,780
Total allocation of profit	32,899	9,046
Proposed distribution	16,472	4,036
Increase in retained profits	16,427	5,010
Retained earnings boy	14,069	6,530
Retained earnings eoy	30,496	11,540
Total retained earnings eoy after distribution	42,036	

Marking guide:
- 2 marks for correct splitting of profit;
- 1 mark for correct handling of proposed release;
- 1 mark for p/h retained profit;
- 1 mark for s/h retained profit.

Total of 5 marks (CJ).

(b)

(i) There are many things that need to be considered before making such a change with policyholder expectations at the core. Therefore the key issues are:

Solvency — future affordability of the bonus needs to be considered. The cost of declaring bonuses at 8% in future years needs to be determined and compared to the available funds to ensure that the solvency of the fund will not be affected in the future. New business also needs to be considered. It is likely that experience will revert to previous levels and any new business would have a natural basis, supporting only 4%. Any increase in the bonus rate would attract new business in this market, thus increasing the problem. This change should not place the fund in a difficult position in future if experience for one or more years is poor. For example, if the total policyholder retained earnings were used to support this change this would provide no buffer for future experience variations.

Stability and policyholder expectations — Reversionary bonus rates are generally expected to be smooth and it's not in the best interests of a company to significantly change them year on year. Hence a significant increase affects policyholder expectations and implies that the increase is going to be maintained in future years.

Equity — this is an open and growing fund. It is the experience of the current cohort of policyholders that has been good. If the product remains open to new business and the bonus rate is increased, the future policyholders receive the benefit generated by the existing policyholders. This is not equitable to the existing policyholders.

Marking Guide:
- 2 marks for each of these answers.

Total of 6 marks (SJ) for the question.

Marking Notes: The textbook also covers "Ease of Calculation" and "Simplicity". The examiners do not believe these are main considerations in this particular situation. However, should candidates present a well reasoned solution in relation to these points, consider awarding 1 mark for each point.

(ii) I do not believe it is appropriate to increase the bonus rate.

The cost of the current year's bonus at 4% is 16,472m, hence at 8% it will be 32,944. This will leave 14,024m in policyholders' retained earnings for future distributions.

While prima facie there are sufficient earnings to support the increase for in force business for the current year, this ignores the effect of assuming that this rate is going to be maintained in the future. Since this is being funded primarily by experience profit in the current year which is unlikely to be maintained, this would place the fund in a position of having to either cut rates in the future (and face a policyholder backlash) or risk breaching solvency and capital adequacy.

When considering the effect of a change on new business one has to review the pricing assumptions being used. As there is no suggestion of a corresponding increase in premium rates, the pricing basis for new business can only support a 4% bonus rate (on the previous assumptions). To the extent that the experience profit is due to one-off impacts (e.g. higher investment returns) there might be no argument to change assumptions, but the better lapse experience might suggest a change in assumptions. If the assumptions change then a higher bonus rate may be supportable.

Some of the policyholder retained earnings may be used to fund new business. Distributing them in the current year and committing to a high rate going forward limits the company's capacity to write new business.

The company also has a choice of whether to apply the rate to new policies (the higher rate would likely lead to increased new business). Not applying it would result in administrative issues, as the product would essentially be split into two. Applying it, on the other hand, would compound the problems highlighted above.

If the company would like to distribute some of the policyholders' retained earnings arising out of good experience in the current year, they can do it via terminal bonuses. There are no expectations placed around the sustainability of terminal bonuses and they can be cut in response to adverse experience in the future.

If the company insists on using reversionary bonuses to distribute the policyholders' retained earnings then this distribution should be smoothed over future years rather than implemented in one year. Hence a rate slightly higher than 4% but not nearly as high as 8% could be adopted.

Marking guide:

- 1 mark for giving a supported opinion;
- 1 mark for cost in current year and recalculated policyholders' retained earnings;
- 1 mark for impact of having to maintain the rates in the future;
- 1 marks for recognising issues around new business;
- 1 mark for suggesting terminal bonus as alternative;
- 1 mark for recognising smoothing of reversionary bonus rates as alternative.

Maximum of 6 marks (CJ).

QUESTION 6 **(20 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	1, 6	3			3
Part (b)	4		7		7
Part (c)	4, 6			10	10
Total		3	7	10	20

Question

You are the valuation actuary for an Australian life insurance company writing both risk and investment business. Your area of responsibility covers only the investment-linked business of the company.

The only investment-linked product sold by the company is a single premium superannuation product. There are no entry or exit fees but there is a 2% p.a. management fee.

The following information has been extracted from the general ledger and valuation systems for the investment-linked statutory fund (all figures are in $m):

Year ending 31 December	2005	2006
Single Premium	500.0	1,000.0
Initial Commission	20.0	40.0
Other Acquisition Expenses	7.0	15.0
Renewal Commission	9.0	12.5
Other Renewal Expense	50.0	60.0
Investment Management Expense	9.0	12.5
Surrenders	300.0	450.0
Policyholder Investment Income	(200.0)	1,342.5
Shareholders' Retained Profits Investment Income	(65.0)	50.0
Policyholder Tax Expense/(Credit)	(20.0)	134.3
Shareholders' Retained Profits Tax Expense/(Credit)	12.6	3.0
Management Fee Income	72.0	100.0
Transfer to Shareholder Fund	0.0	75.0
Policyholder Account Balance	4,200.0	5,858.3
Other Liabilities:		
Creditors	125.0	125.0
Tax provisions	270.0	407.3
Investment Assets	4,750.0	6,352.0
Debtor Assets	250.0	375.5
DAC	500.0	625.0

The company calculates the investment-linked policy liability using the accumulation method.

(a) Using this information calculate the profit for the investment-linked statutory fund for the year ending 31 December 2006. (3 marks)

(b) Calculate the Solvency Requirement and "Excess Assets" at 31 December 2005 and at 31 December 2006 for the investment-linked statutory fund. (Excess Assets is defined as the difference between the total Assets and the Solvency Requirement i.e. essentially the buffer before solvency is breached.)

To assist in performing this calculation you have been given the following additional information:

- **the Minimum Termination Value exceeds the Solvency Liability;**
- **Statutory Offset Capital has been utilised in another statutory fund (and cannot be used for this statutory fund);**
- **to simplify the resilience calculations the company assumes L' equals L for this statutory fund;**
- **at 31 December 2005 the inadmissible assets were $100m and the resilience factor 'f' (i.e. A'/A) was 80%;**
- **at 31 December 2006 the inadmissible assets were $110m and the resilience factor 'f' (i.e. (A'/A) was 75%.**

(7 marks)

(c) A new CFO has recently joined the company. He has read through the valuation report for this business and is concerned with some of the results presented. He has written to you seeking clarification. Prepare your response to the following:

"I am concerned with the decline in the Excess Assets above the Solvency Requirement at 31 December 2006. As I find the analysis of profit approach used by actuaries to be quite useful in explaining the profit, would you please use a similar approach to explain the decline in the Excess Assets."

(10 marks)

QUESTION 6: SOLUTION **(20 Marks)**

(a) First calculate the policy liability:

	2005	2006
Account Balance	4,200.0	5,858.3
DAC	(500.0)	(625.0)
Policy Liability	3,700.0	5,233.3

The profit for the year ending 31 December 2006

Premium	1,000.0
Withdrawals	(450.0)
Investment Earnings	1,392.5
Expenses	(140.0)
Tax on Policyholder Invest Earnings	(134.3)
S/H tax	(3.0)
Movement Policy Liability	(1,533.3)
Profit	132.0

Marking guide:
- 1 mark for calculating the policy liability.
- 2 marks for this profit calculation.

Total 3 marks (KU).

Alternatively, the profit could be calculated as follows:

Management Fee Income	100.0
Management A/C Investment Income	50.0
Expenses	(140.0)
Increase in DAC	125.0
Management A/C Tax Expense/(Credit)	(3.0)
Profit	132.0

Marking guide:
- 3 marks for the alternative profit calculation (KU).

(b) The solvency requirement and the amount of excess assets is calculated as follows ($m):

	Solvency Requirement	2005	2006	Marks	Formula
A	MTV	4,200.0	5,858.3	0.25	Account Balance (and is greater than the solvency liability as stated in the question)
B	Investment Linked Reserve	10.5	14.6	0.75	0.0025 *A
C	Expense Reserve	4.9	10.5	0.75	(1 – 0.3) * Non-comm'n Acquisition expenses
D	CTV	4,200.0	5,858.3	0.25	A (i.e. MTV)
E	Check CTV vs running total	4,215.4	5,883.4	0.5	Max(D, A+B+C)
F	Other Liabilities	395.0	532.3	0.25	As per table in question
G	Resilience Reserve	102.6	185.8	1.50	(1/f-1)*(B+C+F)
H	Inadmissible Assets	100.0	110.0	0.25	As per table in question
I	Solvency Running Total	4,813.0	6,711.4	0.5	E+F+G+H
J	Pol Liab + Other Liabilities	4,095.0	5,765.5	0.5	From info provided
K	Solvency Requirement	4,813.0	6,711.4	0.5	Max(I, J)
L	Total Assets	5,000.0	6,727.5	0.25	As per table in question
K	Solvency Requirement	4,813.0	6,711.4		
M	Excess Assets	187.0	16.1	0.75	L – K

Note: For the resilience reserve calculation the MTV has been excluded. The resilience reserve requirement says that no resilience reserve is required on business where the liabilities move in harmony with the assets. Any change in asset values is reflected in the unit price and passed directly through to the policyholders. Hence, resilience is only being calculated for items B, C and F (and based on the information provided in the question the company assumes that this will not change in value to simplify the calculations). However, dropping out the IL liabilities from the calculations might not be the best for the company.

Marking Note: It is unlikely that candidates would have presented their solution as per the above table. Those candidates who get the right final answers should receive full marks if the method is valid. The only exception should be for candidates who failed to consider the checkpoints against the CTV or Policy Liability and Other Liability and marks should be reduced by those amounts allocated to these checks.

Marking guide:
- Marks as allocated in the above table.
Total of 7 marks (SJ).

(c)

Marking Note: Candidate solutions should be assessed on the difference in Excess Assets calculated in Part (b). Marks should be awarded based on an approach similar to that below. A spreadsheet will be available for markers which may assist with those candidates who made an error in Part (b).

Memorandum

To: CFO

From: A.N.Actuary

Date: 1 November 2005

Subject: Analysis of Movement in Excess Assets

A traditional analysis of profit approach essentially compares the actual result to the expected result. Such an approach cannot be applied to analyse the movement in the excess assets. However, in response to your request I have prepared the following analysis which explains the decrease in the excess assets over the year.

Analysis of movement in excess assets:

Item	Amount	Reason/Explanation	Marks
Cashflow Profit	7.0	Profit less increase in DAC as an intangible asset. Note other liability movement is also taken through here.	2.5
IL Margin on Change in FUM	(4.1)	Increase in IL margin due to higher MTV (no assumption change).	1.0
Change in IL Margin	0.0	Change in assumption on current year FUM.	0
Change in Expense Reserve	(5.6)	Higher non commission acquisition expenses incurred supporting higher levels of new business during the year.	0.5
Resil Reserve on Change in Liability	(36.7)	Growth in Liability, same assumption.	1.5
Change in Resilience Reserve Factor	(46.4)	Change in assumption/factor on current liability arising from less diversification or increased weighting of assets to "riskier" classes.	1.5
Increase in Inadmissible Assets	(10.0)	Some additional assets can no longer be counted for solvency. This should be investigated further to identify how this could be reduced.	0.5
Transfer to Shareholder Fund	(75.0)	Transfer made to Shareholder Fund during the year.	1.0
Total Movement in Components	(170.9)	Sum of the above	1.0
Change in Excess Assets	(170.9)		
Unexplained	0		0.5

Marking guide:

- The solution should cover both a quantification of the item and an explanation of the item.
- Marks allocated as per the above table.
- Deduct 1 mark for inappropriate format.

Total 10 marks (CJ).

END OF PAPER SOLUTIONS