INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 2B LIFE INSURANCE
NOVEMBER 2006 EXAMINATIONS

MARKING GUIDE

Level of Difficulty

Question	Syllabus Aims	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1 (a)	1, 5, 6,10, 11	1, 3, 5		7		7
1 (b)	2A, 5, 6, 11	2A, 3, 5		6		6
1 (c)	2A, 6, 11, 12	2A, 3, 5, 6			5	5
2 (a)	2A, 9	2A, 5	2			2
2 (b)	9	5	2			2
2 (c)	1	1	3			3
2 (d)	2A, 1, 9	2A, 1, 5			5	5
2 (e)	1, 3	1, 2			4	4
3 (a)	1, 2, 3, 4	1, 2	5			5
3 (b)	4	2		6		6
3 (c)	4	2			3	3
3 (d)	4, 10, 12	2, 5, 6			7	7
4 (a)	5	3	4			4
4 (b)	5	3		7		7
4 (c)	5	3		4		4
5 (a)	1, 7	1, 4	3			3
5 (b)	1, 7, 11, 13	1, 4, 5, 6			4	4
5 (c)	1, 7, 11, 13	1, 4, 5, 6			8	8
6 (a)	10	5	3			3
6 (b)	1, 2, 9, 10,11	1, 5		8		8
6 (c)	1, 2, 9	1, 5			4	4
TOTAL			**22**	**38**	**40**	**100**

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QUESTION 1 **(18 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	1, 5, 6,10, 11		7		7
Part (b)	2A, 5, 6, 11		6		6
Part (c)	2A, 6, 11, 12			5	5
Total			13	5	18

Question

You are an actuary working for Omnipresent Life Office (OLO), a medium sized Australian life insurance company selling a range of risk and investment products in the Australian market.

OLO has had a series of losses over the last few years of its operation. Following the last annual valuation the company made 20% of its workforce redundant. In addition, each department was required to reduce its wages cost by 20%.

In the current year new business has been lower than anticipated.

The company values liabilities on a policy-by-policy basis. The most recent valuation of the Yearly Renewable Term (YRT) business for the company has just been run. The valuation results are considerably different from those of the previous valuation, even though the valuation basis remains unchanged. Despite the large experience losses the YRT product is not in loss recognition.

Spot checks have been performed on 10 policies and the calculations have been found to be correct. A preliminary analysis of profit has been performed and the results are as follows:

Item	Profit in $'000
Planned Profit	5,000
Mortality	1,675
Lapses	-3,864
Expenses	-13,934
Unexplained	-706
Total profit	-11,829

The loss from the previous year was $9,815,000.

(a) What would you do to check the valuation result? **(7 marks)**

(b) The CFO is concerned that the current year's loss has increased despite the large reduction in the workforce and has asked you to explain what might be causing this result. Highlight the main points of your response.
(6 marks)

(c) Given the lapse, mortality, new business and expense situation outlined above, what would you advise the company to do in the short term? (5 marks)

QUESTION 1: SOLUTION (18 marks)

(a) I would propose the following checks on the valuation:

- Run the data from the last valuation though the current model to see if the result is the same.
- Check how representative the 10 spot check policies are of the variations in the business – if they are all of one particular type of contract the issue may be with other parts of the model.
- Split the data into groups and compare the results from this year and last year.
- Split the current data into in force greater than 1 year and less than 1 year and compare the in force result with the previous valuation result.
- Split off any riders or options being valued and compare the results of each segment.
- Check the accounting data to make sure that the profit figures are correct.
- Compare the bank account information with the processed figures from the administration system.

Marking guide:
- **1 mark for last year data this year valuation;**
- **1 mark for check how representative the 10 spot checks are;**
- **1 mark for split and compare groups;**
- **1 mark for separate out new business and compare result;**
- **1 mark for split out riders and options;**
- **1 mark for checking accounting data;**
- **1 mark for checking bank account information to processed;**
- **1 mark for any other reasonable points made;**

to a maximum of 7 marks (SJ).

(b)

Direct impact of expense cuts

- New business is lower than last year so there is a smaller than expected base over which to spread the expenses that arise. Whether this causes a bigger new business loss that the previous year will depend on whether sales were down by a greater percentage than expenses or not.
- The current year's loss may have been even greater had the expense reduction not been made.
- Cost of redundancy and similar payments will increase the loss in the current year. This is a one-off impact on profit and will not be evident in next year's result.
- The necessity to complete some work can result in casual staff being hired at higher rates. This can lead to an overall increase in cost with the difference being outside the wages section of the accounts.

- Redundancies and management issues can lead to time being spent by staff discussing these issues rather than completing work and morale issues. This can make the company far less efficient and require either additional contract workers, which will increase costs, or result in backlogs of processing new business.

Potential flow on impacts to NB levels

- The budget was reduced by the same proportion in all departments, this means that the front line staff, sales and new business processing, would also have been cut.
- Doing this will result in a reduction in new business as there are not as many people to generate leads, write business and process it efficiently.

Customer service and therefore retention

- The reputational issues around making staff redundant and also providing poor service to clients can result in clients (and advisers) taking their business elsewhere, leading to an increase in lapses and a lapse cost, which can be seen in the ANOP results.

Other

- The ANOP result – this has indicated there is an unexplained item in the analysis of profit – this means that there is a variation from expected results that is not easily attributed to a particular source or aspect of profit, or indicates an error in the valuation or accounting systems.

Marking guide:
- **1 mark for total loss greater than 20% wage reduction;**
- **1 mark for cost of redundancy payout;**
- **1 mark for other non-wages staff at increased cost;**
- **1 mark for reduced productivity;**
- **1 mark for fewer sales staff and lower new business sales;**
- **1 mark for smaller cost base;**
- **1 mark for existing business leaving;**
- **1 mark for consequences of ANOP;**
- **1 mark for any other reasonable points made;**

to a maximum of 6 marks (SJ).

(c) Short term advice:

- An investigation into which functions are not performing should be made to identify problem areas.
- Increase staff in the front line sales area and provide some incentives to improve sales momentum.
- Increase the customer service staff and have them focus on customer retention.

- Review all expenses of the company to identify unnecessary expenses and possible reductions – for example a large level of director compensation may be able to be reduced given the experience.
- Reduce staff further in non-front line areas, eg sharing more secretarial staff, reducing the accounting and reporting load and associated staffing levels.
- Decide what part of the market OLO can make profits in and focus on this market segment.
- Review product range for marketability in chosen market segments (attractiveness of features, price, competitiveness of commission rates etc).

Marking guide: well-reasoned answers that do not focus on the points raised in (b) may also receive full marks.

– **½ mark for investigation into functions not performing;**
– **1 mark for sales staff changes;**
– **1 mark for customer retention focus;**
– **1 mark for reducing/removing unnecessary costs;**
– **1 mark for simplifying processes and further reducing back office staff;**
– **1 mark for focusing on market analysis and focus on particular market segment;**
– **1 mark for reviewing marketability of product in chosen segment;**
– **1 mark for any other reasonable points made;**

to a maximum of 5 marks (CJ).

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QUESTION 2 **(16 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	2A, 9	2			2
Part b)	9	2			2
Part c)	1	3			3
Part d)	2A, 1, 9			5	5
Part e)	1, 3			4	4
Total		7		9	16

Question

You are an actuary for JFC, an Australian life insurance company. Your company is in the process of developing a new product for release into the Australian market.

This product is a unit-linked, single premium, ordinary investment fund that allows investors access to a balanced portfolio. The product provides a minimum benefit payment under the contract of the initial amount paid into the fund less the initial and ongoing fees payable. This guarantee applies after the fifth policy anniversary.

The fund has an investment mandate as follows:

Asset type	Benchmark	Minimum	Maximum
Australian equities	**60%**	**50%**	**75%**
Australian Government bonds	**40%**	**25%**	**50%**

The Australian Government bonds held will have maturities equal to the expected term of the guarantee.

Assume that there is no default risk on the Australian Government bonds.

(a) Identify any embedded options present in this contract and describe them in terms of an option on the portfolio. (2 marks)

(b) Explain how these must be treated under AS1.03. (2 marks)

(c) Specify a formula for calculating the maximum possible loss to the company that could arise from this option and justify any assumptions made in deriving the formula. (3 marks)

(d) An actuarial student working in your department has suggested that a suitable method of placing a value on the guarantee included in this contract is to review the experience of a closed block of capital guaranteed investment account business also managed by your company. He has suggested that the value should be set by the following formula:

Percentage = S5 / Account Balance

Where:

- **The percentage is applied to the current value of units issued in the new product at the valuation date;**
- **S5 = Sum over 5 years of the total amount that has been required to fund the guarantee on the closed block of business;**
- **Account balance = the account balance at the valuation date of the closed block of business.**

The closed block of business has a discretionary crediting rate policy and a substantial smoothing reserve that has been built up over many years.

Explain any issues that arise from this suggestion. (5 marks)

(e) Comment on how the investment risk of the portfolio could be managed. (4 marks)

QUESTION 2: SOLUTION (16 marks)

(a) Embedded options:

- There is an embedded option with a guarantee of the return of capital less initial and ongoing fees after 5 years provided on the contract.
- This is effectively a put option over the value of the client's account with a exercise price equal to the original value less initial and ongoing fees. This option is only effective after 5 years in force.

Marking guide:
- **1 mark for identifying guarantee;**
- **1 mark for identifying put option;**

to a total of 2 marks (KU).

(b) AS1.03 treatment:

- The best estimate liability projection/accumulation will value the option at zero as long as the best estimate earning rate is greater than the ongoing fees. Therefore, the option would have to be separated from the main contract and valued using appropriate option pricing methodology.
- The value should be added to the BEL and any change in this value will impact the profit and loss statement via the change in policy liability.

Marking guide:
- **1 mark for projection placing zero value on the option and need for separate valuation;**
- **1 mark for value being added to the BEL and the change in the profit and loss;**

to a total of 2 marks (KU).

(c) Maximum loss:

- Australian Government bonds cannot lose their value since we are assuming no defaults on Government debt.
- Therefore the amount at risk would be the amount invested in Australian equities at any point in time, as theoretically these could lose their full value if the assets held defaulted or failed.
- The worst case scenario is that equities lose all their value and no dividends are received.
- The loss is offset by earnings on Government bonds over the five year period
- If this happened then the shortfall in the fund would be the proportion of the fund in Australian equities x the initial investment amount less initial fees less the earnings on Government bonds less ongoing fees charged.

Marking guide:
- **1 mark for Australian Government bonds cannot lose value;**
- **1 mark for Australian equities could potentially lose total value;**
- **½ mark for worst case scenario;**
- **½ mark for offset of Government bond earnings;**

to a total of 3 marks (KU).

(d) Issues with method:

- The block of business being used as a comparison is closed and thus the experience of the business could be affected by this, i.e. higher/lower withdrawal rate.
- The asset allocation is likely to be different for the closed product and thus the risk of the guarantee would be different.
- There is discretion around the crediting rate, thus a lower crediting rate could be declared in good years to support poor years. The new product is unit linked, so value of liabilities equals value of assets.
- There are substantial smoothing reserves for the closed product which would allow the product to support an above-market crediting rate without having to rely on the guarantee.
- The past is not necessarily an accurate predictor of the future and thus the likelihood is that any assumptions based on past data such as this will not reflect the future cost of the option. The past is only one scenario. Need to consider all possible future scenarios to value an option.
- The period being analysed (5 years) is too short to draw any conclusions about the impact of investment markets.
- The investment account contract has a continuous guarantee (after the five years, as opposed to a point in time guarantee) and the option cost is therefore likely to be relatively higher (all other things being equal) as the option to exercise early has value to policyholders.

- The credited bonuses on the investment account product are guaranteed and will result in an increasing exercise price on the put option. This will increase the cost of the option.
- Also, there is a mismatch between the account balances used to determine the guarantee cost vs. that used in the denominator (average of balances over 5 years vs. balance at valuation date.

Marking guide:
- **1 mark for discretion around crediting rate;**
- **1 mark for substantial smoothing reserves;**
- **1 mark for past not accurate predictor of future;**
- **1 mark for period being analysed too short;**
- **1 mark for guarantee being continuous and therefore relatively more expensive;**
- **1 mark for increasing exercise price on investment account;**
- **½ mark for closed business;**
- **½ mark for different asset allocation;**
- **1 mark for mismatch on account balances;**
- **1 mark for any other reasonable points made;**

to a maximum of 5 marks (CJ).

(e) The investment risk could be managed by:

- Dynamic hedging/portfolio insurance – shifting the asset allocation in the portfolio as the value of risky assets moves but limited to minimum/maximum equity exposure.
- Possible restrictions on the use of derivatives in the mandate.
- Reinsuring the portfolio, either directly or using financial reinsurance.
- The risk can be retained on the life company's balance sheet. Stochastic techniques should be used to estimate the reserves required to be set aside to reduce the probability of ruin to a level management is comfortable with.
- Adjusting the portfolio within the equity allocation to choose less risky equity.

Marking guide:
- **1 mark for dynamic hedging;**
- **1 mark for possible restrictions on using derivatives;**
- **1 mark for reinsurance;**
- **1 mark for retaining on balance sheet;**
- **1 mark for less risky equity;**
- **1 mark for any other reasonable points made;**

to a maximum of 4 marks (CJ).

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QUESTION 3 **(21 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	1, 2, 3, 4	5			5
Part (b)	4		6		6
Part (c)	4			3	3
Part (d)	4, 10, 12			7	7
Total		5	6	10	21

Question

You are an actuary working at a large Australian proprietary life insurance company, i.e. it has shareholders. The company has previously sold a range of risk and investment contracts.
In June 2005 the company issued a new lifetime annuity product. The company has not written annuity products before and therefore the contract is competitively priced (with regard to the interest rate used) to attract new business. A new Statutory Fund has been set up to accommodate this product.

The expected capital required to support the business at the end of the first year, using the pricing and expected new business assumptions, is set out below. This is the amount actually reserved for this business before the first official year end valuation.

Item	Solvency requirement $'000 (SR)	Capital Adequacy requirement $'000 (CAR)	Target Surplus held above CAR $'000 (TS)
Liability reserve	**80,738**	**93,701**	
Expense reserve	**2,953**	**-**	
New business reserve	**-**	**18,148**	
Resilience reserve	**11,400**	**14,875**	
Total	**95,091**	**126,724**	**14,591**

It is now June 2006 and you have been reviewing the experience investigations for this product so that the annual valuation can be performed. In the intervening year there have been a number of new medical advancements designed to assist the elderly. This has resulted in a lower level of expected deaths at higher ages.

The MoS profit margin on the pricing basis was 8% of benefits payable. The initial valuation results indicate that the profit margin on the valuation basis is 1.5% of benefits payable.

The new business written for the year is 30% higher than expected based on a comparison of total benefit payment amount. Budgets have been updated to reflect this sales success.

The solvency liability has been calculated at the valuation date to be 119,758 (on best estimate assumptions plus the appropriate margins). The asset/liability matching policy has not changed and has been implemented as expected.

(a) Determine a rough estimate of the Solvency requirement and Capital Adequacy Requirement at the end of the year using valuation assumptions. Provide your rationale for each step in the process. (5 marks)

(b) What are the consequences for the company of these results? (6 marks)

(c) How would your answer to b) change if the product were being written in a Statutory Fund containing other products with $28m of excess policyholder retained earnings (above the capital adequacy requirement for the fund) and $7m of excess shareholder retained earnings?
(3 marks)

(d) You have been asked to draft a memorandum to the Board providing your advice, based on your estimate following the valuation. What advice would you give to the Board?
(7 marks)

QUESTION 3: SOLUTION (21 Marks)

(a) Post valuation results:

The increase in Capital Adequacy Liability (CAL) would be expected to be proportionate to the increase in the SL, thus it would be 119,758 * 93,701 / 80,738 = 138,986.

The increase in the expense and new business reserve would be expected to be proportional to the increase in new business, thus each of these is increased by 30% to 3,839 and 23,592 respectively.

As the matching policy is unaltered and has been able to be implemented accordingly both resilience reserves should increase by in line with the increase in liability reserve (i.e. solvency/capital adequacy liability plus expense reserve plus new business reserve). Thus the resilience reserves for solvency and capital adequacy purposes will be:

Solvency = (119,758 + 3,839)/(80,738 + 2,953) * 11,400 = 16,836
Capital Adequacy = (138,986 + 23,592)/(93,701 + 18,148) * 14,875 = 21,622

Totals for each requirement are therefore:

Solvency = 140,433
Capital Adequacy = 184,200

Marking guide:

- **½ mark for CAL calculation;**
- **1 mark for logic of CAL increase;**
- **½ mark for expense and new business (NB) reserve calculation;**
- **1 mark for logic of expense and NB reserve increase;**
- **½ mark for resilience reserve (RR) calculation;**
- **1 mark for RR logic;**
- **½ mark for total calculation;**

to a total of 5 marks (KU).

(b) Consequences:

- The profit margin of 1.5% would be likely to be below the company's required profit level.
- This product now has a significant risk attached to it of it becoming loss making in the long lifetime of the product.
- The total capital required for the company to retain its solvent status is now estimated to be $140.433 million.
- This means that the capital within the Statutory Fund prior to the valuation is barely sufficient to cover the solvency position provided the target surplus is used for this purpose.
- A full valuation should be performed to assess the true solvency requirement and any breach reported to APRA.
- There is, though, insufficient capital in the fund to support the Capital Adequacy Requirement post valuation.
- Thus an immediate injection of capital is required from the shareholders to support this Statutory Fund (SF).
- Presumably the shareholders would also consider putting additional funds in as target surplus consistent with their current policy, which would mean an additional transfer of shareholder funds would occur.
- The inclusion of this product in this SF has added considerable risk to this Fund that would generally result in higher target surplus being held.

Marking guide:

- **1 mark for profit below likely target level;**
- **1 mark for results in higher risk of losses;**
- **1 mark for recognising solvency requirement much higher;**
- **1 mark for full valuation and reporting any breach of solvency to APRA;**
- **1 mark for recognising exhaustion of capital adequacy (Cap Ad) margin and part of target surplus to support this;**
- **1 mark for insufficient funds for Cap Ad requirement;**
- **1 mark for immediate injection of cash to support this;**
- **1 mark for additional funds required to replace target surplus;**
- **1 mark for increased risk that leads to increase in target surplus held;**

to a maximum of 6 marks (SJ).

(c) Other SF:

- Profitability is still suspect and risky in its own right.
- As the Solvency Requirement and Capital Adequacy Requirement are at the Statutory Fund (SF) level there are likely to be sufficient funds available in the SF to support the product without requiring an injection of shareholder funds.
- There is a profitability issue, though, with supporting these reserves with policy holder retained earnings (PHRE) as it would be expected that these retained earnings would earn a return commensurate with that of the assets of the fund, which they would not if invested in this product.
- The PHRE would need to be available when required for distribution to the policyholders they belong to.

Marking guide:
- **1 mark for profitability still suspect;**
- **1 mark for no additional shareholder injection required;**
- **1 mark for required return on PHRE;**
- **1 mark for PHRE need to be available when required;**
- **1 mark for any other reasonable point;**

to a maximum of 3 marks (CJ).

(d)

MEMORANDUM

To: Board of directors
From: Actuary

Date: 31st October 2006

Subject: Valuation results of new annuity product

We have now estimated the valuation results at the end of the first year for our new annuity product. We are presenting these estimates, rather than final results, because of the serious consequences that the estimates indicate.

The results indicate that mortality at high ages has improved and that 30% more new business has been written than expected. The improvement in mortality has resulted in a 1.5% profit margin, compared with the 8% expected from the pricing report.

The annuity Statutory Fund does not satisfy the Capital Adequacy Requirement. I recommend an immediate injection of $50m to restore capital adequacy and improve our target surplus position. I further recommend the valuation of this fund be completed urgently to confirm the solvency position, which, on my estimates, is precariously balanced. Finally, I recommend that we determine the Fund's target surplus in accordance with the Board's policy and that this amount be paid into the Fund.

The decision to be competitive was made on the assumption that there would be an 8% profit margin for this product. In light of the valuation results it is advised that the pricing of the product be reviewed with a view to reflecting the lower mortality rates expected.

The new business results have also resulted in a strain on the capital required to support the company. The new business results also indicate that we are extremely competitive in the market with this product; 30% above targeted new business results is a large difference.

Sales budgets will need to be revised for the coming year to take the increased new business results into account.

This confirms that we are too competitive in the market and could adjust our pricing to provide better profitability albeit at a lower new business levels.

Regards,
Actuary

Marking guide:
- **1 mark for format and appropriate language use;**
- **½ mark for estimates as opposed to actual figures;**
- **1 mark for competition decision on different profit expectation;**
- **1 mark for recommending capital injection;**
- **1 mark for recommending full solvency investigation;**
- **½ mark for recommending review of target surplus;**
- **1 mark for low profit support for price increase;**
- **1 mark for new business result also supports too competitive;**
- **1 mark for capital strain from additional new business also a cost/issue;**
- **1 mark for changes to sales budgets;**
- **1 mark for recommending price increase;**

to a maximum of 7 marks (CJ).

QUESTION 4 **(15 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	5	4			4
Part b)	5		7		7
Part c)	5		4		4
Total		4	11		15

Question

You are an actuary working in the valuation department of a medium sized Australian life insurance company.

The company has a large book of disability income insurance business. The annual valuation has just been completed and you have been asked to perform an analysis of profit for this business.

You have been provided with the following information (all figures are $ million):

Reserves

	Policy Liability (Active Lives)	Policy Liability (Disabled Lives)
Opening (30/06/2005)	**-87.35**	**39.84**
Expected (30/06/2006)	**-93.54**	**42.10**
Actual (30/06/2006)	**-91.37**	**54.28**

Cash flows

	Premiums	Expenses	Commission	Claims	Interest
	(BOY)	(BOY)	(BOY)	(EOY)	
Expected	**318.17**	**17.68**	**25.45**	**204.47**	**11.38**
Actual	**318.17**	**22.10**	**25.45**	**206.54**	**17.85**

Where BOY is beginning of the year and EOY is end of the year.

The lapse experience and new business is exactly as expected, the profit margin is 42% of claims and the valuation basis has not changed from the 2005 year-end valuation. In addition, you estimate that approximately 90% of the movement in the policy liability was caused by claims experience.

(a) Calculate the pre-tax actual and experience profit for the year-ended 30/06/2006. **(4 marks)**

(b) Identify the components of the pre-tax experience profit for the year-ended 30/6/2006 in the following order so that the table below can be populated.

Experience profit:	
Interest	
Premium	
Expenses	
Commission	
Claims	
Lapses	
Unexplained	
Total	

(7 marks)

(c) Comment on the likely cause of the poor claims experience. (4 marks)

QUESTION 4: SOLUTION (15 marks)

(a) Actual profit:

Cash flow	**$'million**
Premium	318.17
Interest	17.85
Expenses	(22.10)
Commission	(25.45)
Claims	(206.54)
Total	81.93
Release start year reserve	(47.51)
Set up end year reserve	37.09
Profit	71.51

Expected profit = 85.88 (= 42% * 204.47)

Experience profit = -14.37 (= 71.51 – 85.88)

Marking guide:
- **1 mark for cash flow;**
- **1 mark for correct reserve increase;**
- **1 mark for expected profit**
- **1 mark for correct experience profit;**

to a total of 4 marks (KU).

(b) Experience analysis:

Expected interest rate = 11.38 / (-87.35 + 39.84 + 318.17 – 17.68 – 25.45)
= 5%

Actual interest rate = 17.85 / (-87.35 + 39.84 + 318.17 – 22.10 – 25.45)
= 8%

Experience analysis	
Interest	6.69
Premium	0.00
Expenses	(4.64)
Commission	0.00
Claims (payments)	(2.07)
Claims (reserves)	(12.92)
Lapses	0.00
Unexplained	(1.43)
Total	(14.37)

6.69 = (-87.35 + 39.84 + 318.17 – 22.10 – 25.45) * (0.08 – 0.05)
-4.64 = (17.68 – 22.10) * (1.05)
-2.07 = 204.47 – 206.54
-12.92 = ((-93.54 + 42.10) - (-91.37 + 54.28)) * 0.9
-1.43 = -14.37 + 12.94 (sum of above)
= ((-93.54 + 42.10) - (-91.37 + 54.28)) * 0.1

Marking guide:
- **½ mark for expected interest rate**
- **½ mark for actual interest rate**
- **1 mark for interest item;**
- **2 marks for expenses;**
- **2 marks for claims;**
- **1 mark for unexplained included as check;**
- **1 bonus mark for all correct figures;**

to a total of 7 marks (SJ).

(c) The poor claims experience is caused by both an increase in claim payments and an increase in the reserve. This could be caused by:

- The active lives reserve decreased by 4.02m when it was expected to decrease by 6.19m. Since new business and lapses are as expected, the likely cause is higher than expected incidence rates.
- The disabled lives reserve was expected to increase by 2.26m, whereas the actual increase was 14.44m. This suggests that termination rates were lower than expected.
- An increase in incidence rates would also contribute to a larger than expected disabled lives reserve, hence the increase in incidence is likely to be the main cause.
- Both incidence and termination rates adverse experience contributed to the increased claim payments.

- A change in the profile of policies on claim could also have an impact. Even if incidence and termination rates were consistent with expectations overall, more policies with lifetime benefits may have gone on claim than expected which would contribute to a claims loss. Similarly, terminating policies may have had smaller than average reserves.

Marking guide:
- **1 mark for incidence rates;**
- **1 mark for termination rates;**
- **1 mark for incidence being main impact;**
- **1 mark for changing profile;**
- **1 mark for any other reasonable points made.**

to a maximum of 4 marks (SJ).

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QUESTION 5 **(15 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	1, 7	3			3
Part b)	1, 7, 11, 13			4	4
Part c)	1, 7, 11, 13			8	8
Total		3		12	15

Question

You are an actuary working for Excessive Business Growth Ltd. (EBG); a large life insurance company listed on the Australian Stock Exchange (ASX). EBG writes both risk and investment business.

The company's management team is concerned about the value placed upon it by equity analysts in the investment markets and has asked for two alternative valuations to be prepared.

<u>Valuation 1</u>

Valuation 1 will be performed by the actuarial department on best estimate assumptions. The following values are to be produced at 31st October 2006:

Value of in force (VIF)
Value of all future years' new business (VNB)
Adjusted net worth (ANW)

<u>Valuation 2</u>

Valuation 2 will be performed by an equity analyst within the company's funds management operation, based on publicly available information, using the following method:

- **A discounted cashflow approach will be employed using last year's operating profit after tax less a capital charge.**
- **The capital charge is set by applying a cost of capital factor (equal to the difference between the discount rate and the risk-free rate) to the excess of the Solvency Requirement over the policy liability.**
- **The discount rate used will be derived as last year's operating profit after tax, divided by total beginning of year shareholder equity balances for all listed companies in the financial services sector.**
- **The growth rate applied to operating profits will reflect a consensus view of the expected industry growth rate.**
- **Excess assets above the solvency liability are taken at face value.**

(a) Explain how the three components of Valuation 1 are derived to the equity analyst. (3 marks)

(b) What aspects of the two valuation methods would be similar? (4 marks)

(c) Why would the two valuation results differ in practice? (8 marks)

QUESTION 5: SOLUTION (15 marks)

(a) Components of an AV explained:

- An appraisal value is made up of three distinct parts, each of which is valued separately.
- The first part is the value of in force business. This part present values the future expected cash flows from the business that has already been written including the release of regulatory capital backing the in-force book.
- The second part is the value of new business. Here the actuary estimates the volume of new business that is expected to be written for each product in the foreseeable lifetime of the company. These cash flows are then present valued similarly to the in force business.
- The third part of the appraisal value is the adjusted net worth. This represents the assets held by the shareholders that are not required to support the operations of the company. This is usually calculated as the value of the shareholders' fund plus the excess of statutory fund assets over the capital adequacy requirement.

Marking guide: Note the answer must be in language and terms that an equity analyst would understand.
- **1 mark for description of VIF;**
- **1 mark for description of VNB;**
- **1 mark for description of ANW;**
- **1 mark for any other reasonable points made;**

to a maximum of 3 marks (KU).

(b) Theoretically similar because:

- Both methods attempt to allow for the cost of capital. AV explicitly models capital usage and the analyst's method applies a charge to the capital backing the solvency liability in excess of the policy liability.
- The projection for the AV is based on the best known information at the current time and the best estimate of future experience. The analyst's discount rate and operating profit are based on publicly available information giving a market best estimate of worth at a point in time.
- Both methods use a projection of future profits as the basis of the valuation.
- Both methods allow for the impact of new business on value. The AV explicitly through the VNB and the analyst's method through the choice of growth rate.
- Both methods allow for some assessment of free assets at face value.

Marking guide:

- **1 mark for cost of capital;**
- **1 mark for assumptions;**
- **1 mark for profitability;**
- **1 mark for both allowing for new business;**
- **1 mark for both methods allow for free assets at face value;**
- **1 mark for any other reasonable points made;**

to a maximum of 4 marks (CJ).

(c) Differ in practice because:

- The risk profile of this company is likely to be different from the experience of the industry group as a whole. Therefore the risk discount rate may differ between the two methods.
- The analyst has not allowed for the cost of capital on the excess assets above the solvency liability required for capital adequacy purposes, whereas AV explicitly models the capital adequacy requirement in the VIF and VNB.
- The analyst's method implicitly assumes that the capital backing the policy liability grows at the same rate as emerging operating profits. In practice this may not be true as there is an upfront capital strain which gives rise to a stream of future profits over a period of many years. The AV will accurately reflect the capital needs of the business.
- The AV calculates distributable profit for each product group separately, whereas the analyst uses total operating profit. This means that:
  - AV will accurately reflect the change in business mix over time;
  - AV would incorporate tax accurately into its valuation.
- Operating profit will include experience profits and losses that may be one off in nature. The actuary will likely understand the causes of these experience variations and be able to make appropriate allowances in the AV calculation. The analyst's approach will include the experience variations that may be one-off in nature.
- The operating profit will include earnings on retained profits that may have been particularly high or low in the year of the valuation. The analyst's method does not attempt to normalise these earnings whereas the AV will effectively normalise the earnings if the best estimate assumptions are reasonable.
- The publicly available information is at a particular date whereas the AV values are up to date and take into account after balance date changes.
- The AV places an accurate value on new business based on budgeted sales volumes for that specific company whereas the analyst is using a market consensus growth rate.

Marking guide:

- **1 mark for company different risk profile to industry;**
- **1 mark for cost of capital difference;**
- **1 mark for capital strain difference;**
- **1 mark for AV reflecting changing business mix;**
- **1 mark for AV incorporating tax correctly;**

- **1 mark for impact of experience losses;**
- **1 mark for normalising earnings on retained profits;**
- **1 mark for after balance date changes;**
- **1 mark for AV projecting new business growth more accurately;**
- **1 mark for any other reasonable points made;**

to a maximum of 8 marks (CJ).

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QUESTION 6 **(15 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	10	3			3
Part b)	1, 2, 9, 10,11		8		8
Part c)	1, 2, 9			4	4
Total		3	8	4	15

Question

You are the valuation actuary of Investment Linked Funds (ILF); a medium sized Australian life insurance company.

The valuation data provided for the non-participating investment linked business for the financial year ended 30th June 2006 is set out below. All values are in $'000.

	Ordinary	Superannuation
Gross premiums	**108,968**	**928,218**
Income component of premiums	**912**	**9,148**
Investment income	**20,729**	**146,342**
Claims	**77,991**	**731,314**
Expense component of claims	**4,176**	**56,742**
Expenses	**2,705**	**55,267**
Tax	**9,497**	**(7,817)**
Gross policy liabilities at start of year	**145,786**	**3,500,972**
Shareholder retained profits at start of year	**209,575**	**31,104**
Gross policy liabilities at end of year	**182,782**	**3,765,550**
Amount transferred to shareholder fund from shareholder retained profits	**32,568**	**35,400**

(a) Prepare the profit and loss statement for the financial year ended 30th June 2006 in accordance with AASB1038. **(3 marks)**

(b) The Federal Government has decided to introduce a tax of 5% on the deposit component of life insurance premiums. The tax will be borne by the life company and is not deductible for income tax purposes. The tax will apply to any premium received after 1 July 2005. Assume that the product will not go into loss recognition.

Identify the changes that would flow through to each component of the profit and loss statement if this tax were introduced, providing figures where possible. **(8 marks)**

(c) Give your opinion on any significant market or corporate issues arising as a result of this new tax. **(4 marks)**

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QUESTION 6: SOLUTION **(15 marks)**

(a) The profit and loss statement:

	Ordinary	Superannuation
Income component of premiums	912	9,148
Investment income	20,729	146,342
TOTAL INCOME	21,641	155,490
Expense component of claims	4,176	56,742
Expenses	2,705	55,267
Increase in net policy liability	2,755	20,080
TOTAL OUTGO	9,636	132,089
Tax	9,497	(7,817)
OPERATING PROFIT AFTER TAX	2,508	31,218

Increase in net policy liability = gross policy liabilities at end year – gross policy liabilities at start year – (gross premiums – income component of premiums) + (claims – expense component of claims)

Which for ordinary gives:
= 182,782 - 145,786 – (108,968 – 912) + (77,991 – 4,176) = 2,755

Marking guide:

- **1 mark for income component of premiums;**
- **1 mark for expense component of claims;**
- **1 mark for increase in net policy liabilities;**
- **1/2 mark for final profit after tax being correct;**

to a total of 3 marks (KU).

(b) Effect of tax on P&L:

- Premium income: without a change to the accounting standards only the income component of premiums will appear and thus there would be no change to this item in the P&L.
- The adjustments to the gross policy liability to obtain the net liability will not alter as the deposit component of premiums and withdrawal component of claims has not changed.
- There is a change to the valuation basis – the tax change is a Basis 2 change, and the best estimate taxation assumption(s) would need to change.
- As this did not send any products into loss recognition, though, the MoS PL would not change, as it is simply a change of basis. The profit margin would be reduced for these products, though.
- Thus the net policy liability will not change.

- The taxation amount will increase in the P&L.
- Thus taxation changes to 14,900 and 38,137 respectively.
- Operating profit after tax changes to (2,895) and (14,736) respectively.

Marking guide:

- **1 mark for no change to premium income displayed without accounting standard change;**
- **1 mark for same adjustment to gross liability to obtain net;**
- **1 mark for change to valuation basis;**
- **1 mark for no change to MoS PL unless loss recognition;**
- **1 mark for net PL stays as is provided no loss recognition;**
- **1 mark for taxation increases;**
- **1 mark for new tax amounts;**
- **1 mark for new profit amount;**

to a total of 8 marks (SJ).

(c)

- The increase in taxation is substantial, moving both the ordinary and superannuation components of the SF from a profit to loss for the current year.
- Given this is the case in the current year, it is likely that the tax change would result in a significant reduction in profits in all future periods and may send some companies with similar products into loss recognition.
- Therefore some re-pricing can be expected across the industry, so ILF should consider re-pricing.
- The tax will act to improve retention, as it will be charged on reinvestment into another life insurance policy. Existing ordinary business is to some extent 'locked in' due to the tax advantages available to life company products compared to unit trusts. Superannuation business could reinvest with a super trust and so is less locked in as these tax advantages don't apply to superannuation funds.
- The taxation change would therefore seem to be extremely prejudicial and detrimental to a life insurer, as they do not apply to competing savings and superannuation products.
- The deposit premiums of many superannuation clients are already taxed (contributions tax) on the way into the fund. A further tax would reduce the attractiveness of superannuation funds within a life company and business would be expected to leave and move to super trusts.

Marking guide:

- **1 mark for substantial change, profit to loss;**
- **1 mark for reduction in future profits and some companies now in loss recognition;**
- **1 mark for re-pricing;**
- **1 mark for retention;**
- **1 mark for recognising inequity of such a severe change;**
- **1 mark for double up on super contributions;**

– **1 mark for any other reasonable points made;**

to a maximum of 4 marks (CJ).

END OF SOLUTIONS