INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 2A 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)	1,2,4,7	1, 2	4		1	5
1 (b)	1,2,5,6,7,8	1, 2, 3		5		5
1 (c)	6	2			6	6
2 (a)	5	2	4			4
2 (b)	5	2		2		2
2 (c)	5	2		4		4
2 (d)	2, 4, 5	1,2			6	6
3 (a)	1, 2, 7, 14,15	1, 2, 4, 5	5			5
3 (b)	1, 2, 7, 14,15	1, 2, 4, 5		4		4
3 (c)	1, 2, 7, 14,15	1, 2, 4, 5			5	5
3 (d)	1,2,7,12,14,16	1, 2, 4, 5			4	4
4 (a)	1, 2, 4, 7, 12	1, 2, 4	2	4	2	8
4 (b)(i)	6	2	1	1		2
4 (b)(ii)	6	2	1	1		2
4 (b)(iii)	6, 7	2		2	2	4
5 (a)	2,7,8,9,10,14	1, 2, 3, 4	2	4		6
5 (b)	2,7,8,9,10,14	1, 2, 3, 4	2	4		6
5 (c)	2,7,12, 14	1, 2, 4			5	5
6 (a)	8, 9, 14	3, 4	2			2
6 (b)	2	1		2		2
6 (c)	2, 3, 4, 7	1, 2		5		5
6 (d)	2, 7	1, 2			4	4
6 (e)	8, 9, 14	3, 4			4	4
TOTAL			**23**	**38**	**39**	**100**

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QUESTION 1 (16 Marks)

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	1,2,4,7	4		1	5
Part (b)	1,2,5,6,7,8		5		5
Part (c)	6			6	6
Total		4	5	7	16

Question

You are a consulting actuary to Electric Capital Foundation (ECF), a medium sized Australian life insurance company selling only lifetime annuity business to people aged 55 or over.

The company has been in operation for more than 15 years. In its early years of operation the company gained market share through competitive pricing. It has now been in the position of market leader for the last 6 years, which allows it to set the price for the market to a large degree.

The business is split in the following manner:

Curtate duration	Present value of annuity liabilities	%
0	184,967	6%
1	246,623	8%
2	308,279	10%
3	308,279	10%
4	277,451	9%
5	246,623	8%
6	215,795	7%
7+	1,294,774	42%
Total	3,082,791	100%

Age next birthday	Present value of annuity liabilities	%
56-65	709,042	23%
66-75	1,048,149	34%
76-85	894,009	29%
86-95	369,935	12%
96+	61,656	2%
Total	3,082,791	100%

A small amount of surplus assets (7% of current liabilities) has accumulated in the fund in recent years.

The Board has asked you to provide a report in which you are to:

(a) Identify clearly the main risks faced by the company. (5 marks)

(b) Describe potentially suitable strategies to manage those risks. (5 marks)

(c) Discuss the considerations surrounding a suitable asset allocation for the fund. (6 marks)

Draft your report to the Board.

QUESTION 1: SOLUTION (16 Marks)

Report on the risks faced by ECF

Report by: A. N. Actuary

Report to: ECF Board

Date: 31st October 2006

Purpose

The purpose of this report is to discuss the risks faced by the company and the measures that may be taken to manage them, including a suitable asset allocation for the fund.

Specifically, this report answers the questions posed by the Board in your instructions for this work.

(a) The main risks faced by the company are:

- Longevity risk of lives insured – i.e. the actual mortality experience may be lighter than what has been assumed in the course of pricing and/or valuations. The company's profit will be impacted directly in line with all such unexpected differences.
- Investment risk – i.e. the actual investment returns may be lower than what has been assumed in the course of pricing and/or valuations; the lack of assets with suitable durations to match the annuity payments; credit risk; liquidity risk, etc. The company bears the investment risk on this type of business.
- Concentration of business risk – i.e. no ability to offset expenses (or mortality) against other classes that may have different experience.
- Strategic risk – reliant on a single product for profit, sales, etc.
- Pricing risk, particularly on the older business that was more competitively priced [Also, cost of capital must be allowed for correctly, as this product can be highly capital intensive under current solvency requirements.]
- The combined risk of lighter mortality affecting profits adversely (as above) and also driving up a significant business administration expense - paying benefits.
- Competition – the company is the market leader and able to set the price at present, but may be challenged by a competitor and thus lose this ability and possibly be forced to actively compete on price.
- Operational risk – i.e. continuation of payment to annuitants who have died. There is no incentive for the estate of the annuitant to inform the company that the annuitant has died.

Marking guide:

- **1.5 marks for longevity risk, with explanation to clearly identify the risk;**
- **1.5 marks for investment risk, with explanation to clearly identify the risk;**
- **0.5 mark for concentration of business risk;**
- **0.5 mark for strategic risk – narrow reliance;**

- **0.5 mark for pricing risk, and BONUS 0.5 mark for cost of capital;**
- **0.5 mark for longevity driving administration expenses;**
- **0.5 mark for competition;**
- **0.5 mark for operational risk;**

to a maximum of 4 marks (KU). Plus 1 mark for formatting and language (CJ) to a total of 5 marks. Formatting and language must be appropriate for the whole report, including parts (a), (b) and (c), to earn the full mark. As a matter of convention, this mark is added as part of (a); and is determined on a standard basis to constitute CJ.

(b) Potentially suitable strategies to manage these risks include:

- Reinsuring the longevity and possibly investment risk may be considered.
- Writing complementary products, such as YRT, that provide some degree of risk offset for a mortality improvement, alleviate the concentration of business, and diversify the strategic direction and options. [This comes with the issue of taking the business focus away from something that is obviously doing well. A second issue is that the company may not wish to diversify, having operated as a specialist for so long. This option may therefore not be practical or within the aims of the company.]
- Asset-Liability matching is a strategy that should be considered for management of investment risk. This would include modelling investment returns for given asset allocations and investment strategies, to identify the long-term investment outcomes and their probabilities. The model results would then be used to set an optimal asset allocation / investment policy, and keep it under regular review.
- Ensuring liabilities are matched with respect to duration taking into account the surplus accrued – this strategy is potentially suitable for management of the risk arising due to movements in market interest rates and their impacts upon the values of assets and liabilities.
- Establishment of "synthetic" assets (combinations of swaps and options) to enable a better matching by duration of assets and liabilities.
- Regularly undertaking investigations to identify any shortfall in pricing so that any asset/liability mismatch situation can be highlighted and rectified.
- Undertaking good market research to identify the maximum level of pricing that the market will tolerate (given you are the leader), and then adjusting the pricing basis accordingly.
- Continuously improving the efficiency of processing to reduce not only expenses but also the nexus between longevity and expenses.
- Regularly requesting proof of annuitant survivorship (i.e. "being alive"), before the annuity payments is made.
- Monitoring competitors to identify any potential competitive threats early, and try to head them off before they become significant impacts on the company.

Marking guide: NOTE – where 1 mark is available below, the candidate should be awarded ½ mark for identifying that strategy, plus ½ mark for describing how it applies or mitigates risk, as set out below.

- **1 mark for reinsurance: applying it to longevity risk (½), and investment risk (½);**
- **1 mark for complementary products: identified (½), and applying it to longevity/ concentration/strategic risks (½), and BONUS 0.5 mark for issue awareness;**

- **1 mark for Asset-Liability matching: identified (½), and relating it to modelling investment returns (½);**
- **1 mark for ensuring liability matching by duration: identified (½), and applying it to investment risk as related to market interest rates (½);**
- **1 mark for synthetic assets to assist Asset-Liability matching: identified (½), and applying it to investment risk as related to market interest rates (½);**
- **0.5 mark for regular pricing/experience investigations;**
- **0.5 mark for market research into maximum pricing level information;**
- **0.5 mark for continuous operational improvement;**
- **0.5 mark for proof of survivorship before payment;**
- **0.5 mark for monitoring competitors;**

to a maximum of 5 marks (SJ). Note that there are three marks above, all relating to aspects of "Asset-Liability matching": A candidate who does not separate the answer into different points should still get equivalent marks, providing the respective parts are covered or included to the same degree in the answer given.

(c) The considerations surrounding a suitable asset allocation for the fund have to take into account the long-term nature of the liabilities; the need for liquidity, or at least regular asset cash flows from investments to cover regular liability cash flows in the form of benefit payments; and the small surplus within the fund. These interests are largely competing. Discussion of a suitable asset allocation would include the following considerations:

- The long-term nature of the liabilities would generally indicate a high level of growth assets; however that is not appropriate for this type of business, due to the guarantee provided by the company and the regular benefit payments of the fund.
- Long term assets of a suitable type may not be available without a significant degree of reinvestment risk requiring ongoing portfolio management and readjustment.
- The liquidity requirement in an annuity fund would usually indicate a large proportion of defensive assets being required; but in this case, the payments are spread in a reasonably steady fashion over approximately 20 years, thus reducing the degree of liquidity requirement. There is also no surrender value (generally), so the liability profile is more well-defined. This may permit investment in less liquid assets provided the relevant cash flows are matched to liabilities.
- The guarantee of the insurer requires a reasonably defensive portfolio so that the liabilities can be met as and when they fall due, and particularly given that the business is very long duration.
- The small surplus allows a slightly riskier asset allocation to be taken as these funds can be risked to produce a better return.
- Consequently an asset allocation of fixed interest matched by duration over most of the portfolio would be best with duration management being undertaken. The small surplus could be invested in 60% equity/40% defensive to give some upside while still protecting some of the surplus should it be needed if experience changes.

Discussion of particular asset classes might incude –

- Types of fixed interest assets, e.g. Government bonds, or the option of higher risk/ higher return fixed interest securities – possibly a mix of the two types. These may depend on availability at suitable durations, as well as market depth, etc;
- Indexed bonds; hedging/options/swaps in combinations to achieve "synthetic" assets. This may enable a better matching of assets and liabilities by duration, and may also depend on availability, as well as costs, market depth, etc;
- Overseas assets, with appropriate currency hedging (to the degree possible in practice) to avoid currency risk, may expand asset allocation options – a range of practical issues would need to be addressed (e.g. investment management costs, custody, etc.).

Marking guide: NOTE – where 1 mark is available below, the candidate should be awarded ½ mark for identifying each consideration, plus ½ mark for discussing its suitablility, as set out below.

- **1 mark for largely competing interests of term, cash flow/liquidity, small surplus, etc: interests identified as considerations (½), and recognised as competing (½);**
- **1 mark for long-term usually indicates higher growth: long term identified (½), and linked to need for higher growth (½);**
- **1 mark for long term assets not available: issue identified (½), and adequately discussed (½);**
- **1 mark for liquidity considerations: identified (½), and adequately discussed (½);**
- **1 mark for guarantee and long duration: identified (½), adequately discussed (½);**
- **1 mark for considering whether to use surplus for additional return or not: identified (½), and adequately discussed (½);**
- **1 mark for recommending an asset allocation that is reasonable: identified (½), and adequately discussed (½);**
- **1 mark for types of fixed interest assets: identified (½), adequately discussed (½);**
- **1 mark for other suitable types of assets: identified (½), adequately discussed (½);**
- **1 mark for option of overseas assets: identified (½), and adequately discussed (½);**

to a maximum of 6 marks (CJ).

QUESTION 2 (16 Marks)

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	5	4			4
Part (b)	5		2		2
Part (c)	5		4		4
Part (d)	2, 4, 5			6	6
Total		4	6	6	16

Question

You are an actuary on the underwriting committee of Royal Life Assurance Group, an Asian company successfully writing whole of life and endowment business in a growing market.

Your company has decided to issue a new yearly renewable term (YRT) product with a total and permanent disablement (TPD) rider. These products are only available on adult lives and will be distributed using insurance advisers.

The underwriting committee has asked you to provide it with your comments on the following questions for its next meeting. Identify clearly the points you would raise.

(a) What are the additional non-financial underwriting risks raised by these new products? (4 marks)

(b) Why would financial underwriting be more important for these new products? (2 marks)

(c) What are the financial underwriting techniques that the underwriters would be expected to apply for these new products? (4 marks)

(d) What other methods could the company use to reduce or manage the insurance risks associated with these new products? (6 marks)

QUESTION 2: SOLUTION (16 marks)

(a) The additional non-financial underwriting risks raised by these products include the following:

- Morbidity is covered under the TPD rider to this product. The company has previously only been accustomed to underwriting death cover. To this extent, "morbidity" is a new insurance risk; therefore, underwriters may lack relevant experience and not underwrite TPD to the required standards.
- The TPD rider would usually be optional, and this adds the risk that the people more in need of the cover due to their personal risk profile will take the policy, which will affect the experience adversely. The "optional" dimension of the rider further reinforces its distinct importance in the underwriting process, due to the higher risk of morbidity anti-selection under an optional benefit.

- The sum insured to premium ratio is much higher for these products, as there is no savings component in the premium rates. This can encourage over-insurance, and may exaggerate any effect of non-disclosure. If non-disclosure is thus more likely under these products, it is a risk aspect that underwriters need to pay more attention to in the underwriting process.
- General affordability of the premium rates opens the insurer to a different market with different health and lifestyle characteristics. This can affect the mortality and morbidity experience. As "target market" is the first aspect of the selection process, this may lead to underwriting concerns that the company has so far not confronted (or has very limited experience), e.g. AIDS underwriting.
- Lack of a surrender value would generally result in higher lapses, particularly for those lives who decide the insurance no longer has a benefit for them – presumably the healthier lives. This "anti-selection" aspect is more significant under these products, and means that underwriting remedies such as premium loadings may need to be reassessed by comparison with WL and EI products.
- Anti-selection would be greater for these products due to many of the points mentioned above, e.g. higher sum insured for premium, greater affordability. This has direct implications for underwriting both mortality and morbidity risks, and the nature, extent and cost of underwriting – as well as its effectiveness.

Marking guide:

- **1 mark for morbidity as a new feature - lack of relevant underwriting experience;**
- **1 mark for rider optional – reinforcing underwriting risk;**
- **1 mark for SI to premium ratio higher – e.g. non-disclosure increases;**
- **1 mark for general affordability leading to different lives – new underwriting concerns;**
- **1 mark for lapse issue due to lack of SV – underwriting remedies need reassessment;**
- **1 mark for anti-selection - implications for underwriting;**

to a maximum of 4 marks (KU). There is one mark for each of the above risks, which should be awarded as ½ mark for stating the risk, plus ½ mark for clearly identifying it (by brief explanation). While "anti-selection" arises in a number of the above points, there are separate aspects which should be awarded marks provided they are identified clearly.

(b) Reasons why financial underwriting would be more important for these new products include:

- Affordability of premium leads to larger sums insured, with the result that the levels of cover available are more likely to require to be justified in each case. This is to avoid undue concentrations of insurance risk, as well as moral risk (e.g. fraud, suicide, lack of insurable interest, etc.).
- Anti-selection in particular may be more of an issue when there is a larger benefit payable for a smaller premium outlay. "Lack of need for cover" may indicate higher risk of anti-selection.
- Larger sums insured will require higher levels of reinsurance, which is often dependent on satisfactory financial underwriting.

- High levels of TPD sums insured under an optional rider benefit should be given closer scrutiny in particular, relative to the financial need for cover.
- With traditional business the premium rates result in the sum insured requested being to some extent self-limiting, whereas under YRT this limit will need to be applied more pro-actively by the underwriter, who will need to ensure that the cover being requested is justified.

Marking guide: NOTE – where 1 mark is available below, the candidate should be awarded ½ mark for stating each reason, plus ½ mark for clearly identifying it (by brief explanation).

- **1 mark for recognising affordability of premium is an issue – scale of risk;**
- **1 mark for recognising anti-selection is an issue – lack of need may indicate risk;**
- **½ mark for reinsurance requirement;**
- **½ mark for TPD needing closer scrutiny;**
- **1 mark for traditional business premium rates being self-limiting – underwriters needing to apply limits with YRT product;**

to a maximum of 2 marks (SJ).

(c) The financial underwriting techniques that the underwriters would be expected to apply include:

- Identifying the reason for the cover requested and making sure the motivation behind this is reasonable.
- Checking that the sum insured is reasonable for the purpose of the insurance. For example, a $20m sum insured would not be reasonable to cover a $500,000 debt.
- Checking the asset and liability situation of the insured to ensure that there is no indication of apparent motivation for anti-selection and/or over-insurance (i.e. “moral hazard”).
- Checking the earnings of the life insured to ensure that the cover is reasonable and able to be afforded. Evidence of income may be requested by the life insured providing the company with copies of recent tax returns, reducing the risk of overstatement for insurance purposes.
- Obtaining details of the debt to be covered if this is the reason for the insurance; consider amount, duration, etc.
- Checking for the existence of other current life insurance policies, which would reduce the need for protection to the extent that they provide ongoing cover.

Marking guide:

- **1 mark for reason/motivation behind cover – check it is reasonable;**
- **1 mark for sum insured reasonable – by comparison with needs;**
- **1 mark for asset/liability situation – any indication of moral hazard;**
- **1 mark for earnings/affordability – ask for evidence to avoid overstatement of needs;**
- **1 mark for details of debt – consider size, terms;**
- **1 mark for checking other life insurances already in place;**

to a maximum of 4 marks (SJ). There is one mark for each of the above techniques, which should be awarded as ½ mark for stating the technique, plus ½ mark for clearly identifying it (by brief explanation).

(d) Other methods the company could use to reduce or manage the insurance risks include:

- Reinsurance, particularly surplus arrangements, can be used to limit the exposure to large sums insured. The benefits of reinsurance would also include support with the underwriting of unusual risks, and access to training from the reinsurer.
- Setting sales requirements/goals/restrictions that the advisers are to follow when selecting clients for the product, as a means of managing "target market" as the first aspect of the selection process.
- Allowing an additional margin for risk in the premium rates, particularly given this is a new product into the market. While not exclusive in its effect to "insurance risks", this method is a common strategy for new products.
- Reducing the non-medical limits to increase the medical information required, and/or as a deterrent to anti-selecting clients.
- Obtaining the advice of a qualified doctor for difficult or unusual cases.
- Restricting the maximum sum insured available on the product, or at least on the TPD rider.
- Closely monitoring each of mortality and morbidity experience.
- Adding a suicide clause and the restriction of payment of benefits in the first year policy year.

Marking guide: Each of the following methods should be awarded ½ mark for stating the method, plus ½ mark for clearly identifying it (by brief explanation). In the case of reinsurance, there are two additional ½ marks available for references to training and underwriting support.

- **2 marks for reinsurance, including underwriting support and access to training;**
- **1 mark for sales requirements, to manage "target market";**
- **1 mark for margin in rates, as common for new products;**
- **1 mark for reducing non-medical limits to increase medical evidence and/or deter anti-selection;**
- **1 mark for doctor's advice, in difficult/unusual cases;**
- **1 mark for restricting maximum sum insured;**
- **1 mark for monitoring experience;**
- **1 mark for restrictions on payment for suicide;**

to a maximum of 6 marks (CJ).

It is conceivable that a candidate may take a different approach to this part, based on a different interpretation than the examiners have intended. Such an approach may proceed to describe possible "underwriting methods or techniques"; e.g. blood tests, questionnaires, etc. In any such case, the answer needs to be considered on its own merits, in light of how it addresses itself to the question actually asked. While not suggesting any such instances receive no marks, the reasonableness of that candidate's interpretation needs to be taken into consideration in deciding what

marks are appropriate, as well as the quality of their answer. It is suggested, as a guide, that where a candidate focuses solely on "underwriting techniques", they should receive a maximum of 1 mark only, as they have missed a number of other key alternatives in the solution for reducing and managing the risks.

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QUESTION 3 (18 Marks)

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	1, 2, 7, 14,15	5			5
Part (b)	1, 2, 7, 14,15		4		4
Part (c)	1, 2, 7, 14,15			5	5
Part (d)	1,2,7,12,14,16			4	4
Total		5	4	9	18

Question

You are the product actuary of Xanadu Life Company. Your company is developing a regular premium investment account product for release into the Mongolian market. Premiums will generally be received on a fortnightly basis, as the product is intended to operate as a savings plan. This will be the first product of its kind in this market, however it is expected that competitors will arrive within the next 3 years.

Several aspects of the proposed product design are described below:

Fees		
Initial	**25.0%**	**of contractual annual premium (the annualised total amount contracted to be paid into a policy each year), charged at a monthly equivalent rate over the first 12 months of that policy.**
Management	**5.0%**	**p.a. of all premiums paid, including those in the first 12 months as well as ongoing premiums paid, charged at a monthly equivalent rate over the life of a policy.**
Asset	**0.4%**	**p.a. of policyholder account balance, charged at a monthly equivalent rate, to cover the costs of asset management and investment.**

Surrender value basis: Surrender value = Factor x account balance

where Factor is:

Curtate duration	Factor
0	**0%**
1	**40%**
2	**60%**
3	**80%**
4+	**100%**

Crediting rate policy:

The rate to be credited is at the discretion of the company. It is generally expected that the following formula will be used to determine the crediting rate in any given year:

Crediting rate = 1/3 x $\{R_t + R_{t-1} + R_{t-2}\}$

where R_t = the earning rate for the most recent year-end (Year t)
less 1.5%,
and the deduction of 1.5% consists of:
0.5% to be transferred to a crediting rate smoothing reserve, and
1.0% transferred to shareholders, to compensate for the cost of supporting the capital guarantee and to provide an allowance for profit.

The appointed actuary has advised that a significant portion of this product's development costs will not be recovered by the proposed product design. The total amount of this shortfall has been quantified as 15% of the amount of premiums expected to be received in the product's first year of operation. The actuary also believes that there is little prospect of reducing costs or increasing planned sales to cover this shortfall.

You have been asked to participate in discussions on this issue at the next Product Committee meeting, and to review four different methods that have been suggested to handle this issue (itemised below).

Prepare your assessment of the features of each method, for presentation to the Product Committee meeting, as input to the discussions.

(a) Increasing the Initial Fee from 25.0% to 40.0%. (5 marks)

(b) Increasing the Initial Fee from 25.0% to 30.0%. (4 marks)

(c) Increasing the Management Fee from 5.0% to 6.5% over all policy years. (5 marks)

(d) Introducing a discretionary expense recovery term in the calculation of R_t, thus reducing the crediting rate. (4 marks)

QUESTION 3: SOLUTION (18 Marks)

(a) Increasing the Initial Fee from 25% to 40%:

- This should result in the 15% shortfall amount being fully recovered from the higher initial fees derived based on the amount of premiums expected to be received in the first year, so it is good in that the shortfall is recovered quickly.
- As the surrender scale is quite severe in the first year, there is a reasonable probability of recovery for any policies that surrender in the first year of the product, and also a substantial disincentive to surrender. This affords reasonable protection against any loss of "shortfall recovery" due to levels of surrenders rising above the expected levels over the first year. In fact, the surrender scale is likely to over-recover on initial expenses in the early years for surrendering policies over and above the expected levels.
- The issue with this is, "How do you present the product, and in particular, what happens in the second and subsequent years?" If the initial fee remains at the

higher level and the shortfall has in fact been fully recovered, then 15% more than required would be received in later years. On this basis, the initial fee will be too high if retained at 40%.

- It would generally be expected that new business would increase after the first year, which would exacerbate this problem of "over-charging".
- A charge this high is likely to affect new business volumes adversely (as the product would be that much harder to market), thus the new business assumptions would be likely to change, which would most likely compound the issue (higher fees on lower sales taking longer to recoup the shortfall), rather than relieve it. Such a high charge may also hasten the entry of competitors, undercutting the product and further eroding new business volumes, as sales flee elsewhere.
- If the fee were reduced back to 25% after the first year in operation, there would be equity issues and possibly discontent from the first year's cohort of policyholders.
- The total fee removed from first year's premiums is 45% when the management fee is included, which is very high. At this level, the product is that much less attractive to policyholders, reinforcing the likely effect on new business levels.
- The development costs should be recovered over a greater period than the first year of the product, as the product is expected to survive, with adjustments from time to time, for many years. This is a focal point to recognise in this question.
- The shortfall in expenses, given the level of fees being charged, would indicate that the commission rates under the contract are likely to be quite substantial. This may affect considerations of whether the fee increase can be defended.

Marking guide:

- **1 mark for quick recovery of shortfall – one year;**
- **1 mark for probably recover on exits, plus a disincentive, due to surrender scale;**
- **1 mark for 'How to present?' – initial fee too high if continued, thus 'overcharging';**
- **1 mark for 'over-charging' exacerbated by any increases in new business;**
- **1 mark for adverse effect on NB assumptions and 'compounding' consequences;**
- **1 mark for equity issues and/or discontent if reduced at end of first year;**
- **1 mark for combined with management fee giving very high total fee;**
- **1.5 marks for development costs be spread over longer period, given product life;**
- **1 mark for recognising commission possibly quite high – may be hard to defend;**

to a maximum of 5 marks (KU). Half marks can be awarded for valid points stated, where quality of assessment is missing or less substantial (i.e. where half mark is judged more appropriate than none at all).

(b) Increasing the Initial Fee from 25% to 30%:

- This should result in the 15% shortfall amount being recovered from the higher initial fees derived based on the amount of "first year" premiums expected to be received over a period more like the first three years, rather than just one year. The shortfall would therefore take three times as long to recover, relative to (a), on the assumption that new business volumes are similar for respective periods.
- As the surrender scale is quite severe in the first 3 years (particularly in the first), there is a reasonable probability of recovery for any policies that surrender in the first 3 years of the product, and also a substantial disincentive to surrender. This

affords reasonable protection against any loss of "shortfall recovery" due to levels of surrenders rising above the expected levels over the first three years. In fact, the surrender scale is likely to over-recover on initial expenses in the early years for surrendering policies over and above the expected levels. This becomes more important, the longer the period of recovery for the 15% shortfall amount.

- This would still result in too much being recovered (i.e. 'over-charging) in the new business from year 4 onwards, but to a much smaller extent than with the option of an increase to 40% under (a).
- It is likely that there would be competitive pressure at the end of 3 years that would result in fees being reduced in any case, due to the anticipated entry of competitors within that sort of timeframe.
- The increase is not so high that it would markedly affect anticipated new business volumes (in contrast to the option of increase to 40% under (a)).
- The spreading of the un-recovered product development costs over the realistic life of the product is more equitable as all policyholders contribute, hence less likely to generate discontent from the relevant cohort of policyholders.
- The development costs should be recovered over a greater period than the first three years of the product, as the product is expected to survive, with adjustments from time to time, for many years. Again, this is a focal point to recognise in this question.
- A smaller increase in the level of fees being charged would be less likely to expose the commission rates to as close a scrutiny as the increase to 40%.

Marking guide:

- **1 mark for slower (than option (a)) recovery of shortfall – 3 years;**
- **up to 1.5 marks for assessment of surrenders: probably recover on exits, plus a disincentive due to surrender scale – in fact, surrender scale over-recovering in early years;**
- **1 mark for year 4 onwards issue (still too high if continued, but less than for (a));**
- **1 mark for significance of this issue dampened by competition anyway;**
- **1 mark for less likely (than option (a)) to affect new business assumptions;**
- **1 mark for more equitable and less likely to result in discontent;**
- **1.5 marks for development costs spread over life of product;**
- **1 mark for less likely to expose commission to scrutiny;**

to a maximum of 4 marks (SJ). Half marks can be awarded for valid points stated, where quality of assessment is missing or less substantial (i.e. where half mark is judged more appropriate than none at all).

Comments can be included that contrast option (b) with (a), e.g. option (b) would be easier to market than (a); (b) is more attractive to policyholders; etc. To the extent these comments show knowledge along the lines of the above marking guide, they should receive similar credit. However, markers should be wary of a "mechanical rehash" of the same points; if this is significantly apparent, markers may award only half marks as they believe appropriate. In the extreme, a candidate who simply says "similar issues to (a)" might be awarded few or even nil marks.

(c) Increasing the Management Fee from 5.0% to 6.5% over all policy years:

- Reduces the certainty of recovering the costs as it is spread over a longer period (e.g. in the order of 5-6 years, or possibly more).
- Spreads the recovery over a longer period, which may also have implications for capital being required to support the new business strain. The average expected policy duration now becomes important, as that is needed to estimate when the shortfall of costs will be recovered.
- A portfolio model, including growth of new business and in force, as well as assumed exits, may be of assistance. The effects of varying experience, and the impact of competitors, may also be considered under sensitivity testing.
- Effectively shares some of this cost with shareholders, as surrenders in later years (at curtate duration 4+, where no surrender factor applies) will affect the ability to recover enough to support the initial strain. This will emerge in the form of lower profitability.
- As the surrender scale is quite severe in the first 4 years (particularly in the first), there is a reasonable probability of recovery for any policies that surrender in the first 4 years of the product, and also a substantial disincentive to surrender. This affords reasonable protection against any loss of "shortfall recovery" due to levels of surrenders rising above the expected levels over the first four years. In fact, the surrender scale is likely to over-recover on initial expenses in the early years for surrendering policies over and above the expected levels. This becomes more important, the longer the period of recovery for the 15% shortfall amount.
- Later surrendering policyholders will not pay their fair share of the initial costs incurred on their behalf, so there is an equity issue between those staying and those surrendering (and in the latter case, depending also on duration at exit). Again, a portfolio model may help with assessment of this.
- Allows the product to be more robust should competition materialise.
- Depresses comparative net earnings rates (taken for this purpose as crediting rates less the increased management fee) on the product, making it less attractive.

Marking guide:

- **1 mark for longer period – reduces certainty of recovery;**
- **1 mark for implications for capital being required – average duration important;**
- **1 mark for portfolio model may help, e.g. sensitivity testing;**
- **1 mark for shares some cost with shareholders, via lower profitability;**
- **up to 2 marks for assessment of surrenders: probably recover on exits, plus a disincentive, due to surrender scale in early years – in fact, surrender scale over-recovering in early years, then not recovering at all in later years;**
- **1 mark for equity issue/later surrenders will not pay fair share;**
- **1 mark for more robust product, in the event of competition;**
- **1 mark for less attractive due to depressed comparative net earnings rates;**

to a maximum of 5 marks (CJ). Half marks can be awarded for valid points stated, where quality of assessment is missing or less substantial (i.e. where half mark is judged more appropriate than none at all).

(d) Reducing the crediting rate by a discretionary expense recovery term:

- Extends the time period for recovering costs- closer to (c) [or longer] than to (a) or (b). For that reason, a number of comments in (c) may also apply here, e.g. lower certainty of recovery, capital required, depressed comparative net rates, etc.
- Easy to adjust and therefore more flexible as conditions change, as the crediting rate is at the discretion of the actuary. For example, it may be possible to recover more quickly than under (c) in years when investment returns are strong; and ease the impact when they are weak. There is an obvious "floor" of zero.
- Discretion adds to administrative complexity, exposure to closer scrutiny, dilution of company resolve etc. Discretion may also pose a problem from other aspects, e.g. marketing impediment, potential legal/regulatory constraints, disclosure requirements etc.
- May reduce competitiveness (from the viewpoint of "comparative net rates") if the reduction still needs to be applied after competitors have entered the market – this is one of the most obvious (simple & transparent) comparisons for customers. The 'trade-off' is between explicit charges under the other three options, against less visible charges but quite obviously lower net earned rates under this option.
- Advantages of this option over (a) and (b) are similar to those of (c); essential differences between (c) and (d) relate to whether the focus is on "fees" or "gross" earned rates (pre- or post-discretionary factor), or "net" earned rates, after all adjustments. These depend on the specific context of a particular market. As to whether recovery period is more or less than (c), will depend on whether the discretionary element is generally expected to be (the % aum equivalent of) an amount greater or less than a management fee difference of 1.5% of premium.
- The capital guarantee means no less than zero can be declared. Market conditions may require a minimum of some small positive declared rate. In either case, the effect is to limit discretionary adjustment and thus extend the period of recovery.
- May be inequitable - recover less than fair share from surrendering policyholders, while 'unfairly' imposing much of the cost on new entrants.
- If investment performance is consistently poor this may become unworkable, as the crediting rate may need to be increased to attract and retain business.

Marking guide:

- **1 mark for extends time period for recovery, and points "similar to (c)";**
- **1 mark for easy to adjust, hence greater flexibility (advantages of discretion);**
- **1 mark for administrative complexity/other constraints (disadvantages of discretion);**
- **1 mark for comparative competitiveness aspects;**
- **1 mark for recognising features of this option, relative to the other three;**
- **1 mark for consideration of capital guarantee and limits on this method;**
- **1 mark for inequitable for those who stay, relative to new entrants;**
- **1 mark for unworkable if poor returns;**

to a maximum of 4 marks (CJ). Half marks can be awarded for valid points stated, where quality of assessment is missing or less substantial (i.e. where half mark is judged more appropriate than none at all).

Comments can be included that contrast option (d) with (a) to (c), e.g. option (d) would be easier to market than (c); (d) is more attractive to policyholders; etc. To the extent these comments show knowledge along the lines of the above marking guide,

they should receive similar credit. However, markers should be wary of "mechanical rehash" of the same points; if this is significantly apparent, markers may award only half marks as they believe appropriate. In the extreme, a candidate who simply says "similar issues to (c)" might be awarded few or even nil marks.

QUESTION 4 **(16 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	1, 2, 4, 7, 12	2	4	2	8
Part b) i)	6	1	1		2
Part b) ii)	6	1	1		2
Part b) iii)	6, 7		2	2	4
Total		4	8	4	16

Question

You are an actuary working in the product area of a large Australian life insurance company. The Australian Federal Budget of May 2006 announced changes to the taxation of superannuation benefits, specifically that recipients will no longer be taxed on benefits paid from superannuation funds, which will make superannuation a very attractive savings vehicle for Australians.

Your company would like to take advantage of these changes by launching a new unit linked superannuation product. The product design that the marketing department has developed is as follows:

Product name	**Capital Guaranteed Deferred Annuity**
Benefits payable	**A lump sum of accumulated superannuation monies upon retirement. Benefits may be transferred to another superannuation fund prior to retirement.**
Premiums	**Single amounts transferred from other superannuation plans at the discretion of the investor.**
Investment options	**Three investment options are available:** **Equity – predominantly invested in shares** **Balanced – invested in a broad mix of assets** **Capital Stable – predominantly invested in fixed interest**
Guarantee	**The excess (if greater than zero) of the original dollar value of premiums, less the dollar value of any transfers out of the product, is guaranteed as a minimum amount payable upon retirement.**
Pricing	**Unit prices will be calculated and issued on a daily basis for each investment option.**

(a) Identify the possible drawbacks that arise with this product design. **(8 marks)**

(b) Explain whether each of the following methods would be suitable for managing the guarantee being provided for this product, as related to the Equity option:

(i) Portfolio insurance provided by the investment manager. **(2 marks)**

(ii) Asset-Liability matching, using modelling tools. **(2 marks)**

(iii) A series of 3-month duration Exchange Traded Options purchased by the company on the equity market index, with the floor value (exercise price or guaranteed amount) of the option determined as:

[(Total value guaranteed under the contract) / (total asset value at the beginning of the quarter)] x (value of the market index at the beginning of the quarter). (4 marks)

QUESTION 4: SOLUTION (16 marks)

(a) The possible drawbacks that arise with this product design are:

- Limited (i.e. narrow) appeal of this product, when there are other products that allow regular contributions, non-super payments into the fund and transfers from other superannuation plans.
- The cost of the guarantee would be very different for the three investment options; each would have to be handled separately.
- This would be likely to result in a different product fee structure for each of the investment options (which adds to design complexity) plus the guarantee would need to be managed separately (probably at fund level) for each option, further complicating the intent of introducing a simple product. Switching between the options may no longer be a simple proposition if product fees vary by option.
- The capital guarantee would encourage more investors to put their funds into the Equity option, which is inherently a higher risk for higher return option. To the extent that the company bears the risk that its strategy for capital guarantee may prove less than 100% effective, this will tend to increase the company's risk.
- If this occurs, then the other two options may be much less likely to prove viable. Indeed, extending the guarantee to all three funds may simply result in the absence of a "real" range of investment options, with all three simply appealing to the same sort of investor (i.e. risk-averse), while failing to genuinely appeal to a broader spectrum of investors. True seekers of Equity exposure who do not want any guarantee would find this "Equity option" unattractive, as it increases their costs in a way that fails to match their investment appetite. Similar remarks apply to the Balanced option.
- The popularity of the Equity option (see point above) would make the guarantee difficult and potentially costly to manage, given the investment risk being taken by the company. It will become more demanding on management attention as its exposure increases.
- Informed investors may transfer funds (or switch inwardly) in on an upwardly moving market and remove them (or switch out) if the market moves down, thus selecting against the company by exploiting any timing opportunities, while still enjoying a capital guarantee at the company's expense.
- In the event of a market movement that resulted in the guarantee being invoked, more informed investors might transfer funds to another provider to lock in the guarantee. This may cause liquidity issues for the company, as the product design effectively promotes a run on the fund when it is most vulnerable.
- The impact on unit pricing as a result of these transfers – there may need to be the option to strike "intra-day" prices. The question does not specify whether prices are determined in advance or in arrears – the difference would have implications

for investor opportunity to anti-select (and hence the impact on the guarantee), as well as administrative implications.

- The guarantee may be viewed as inconsistent in that the dollar value of units transferred out is reflected in the guarantee, rather than the original dollar amount that this sum has accumulated from. This "design aspect" of the guarantee may lead to confusion, policyholder complaints etc. that may prove costly and time-consuming to deal with.
- For the guarantee to operate effectively, amounts will need to be recorded carefully in the system – adding to the complexity of the IT requirements.
- The administration of the product is complex and would potentially lead to reliance on the computer system for values. Thus errors are (a) perhaps more likely to occur, and (b) less likely to be picked up by administration staff.
- Capital requirements under the Life Act and the cost of providing capital.
- Performance of the "Equity" and "Balanced" options may compare quite unfavourably with other funds marketed by similar names that don't include a capital guarantee. This may detract from the purpose of offering a range of different "options".

Marking guide:

- **1 mark for limited/narrow appeal compared to other products (KU);**
- **1 mark for cost of guarantee very different for each option (KU);**
- **1 mark for different product fees required per option, adding to complexity (SJ);**
- **1 mark for encourage investors to high risk option, increasing company risk (KU);**
- **1 mark for other options then less viable / actually results in narrow appeal (SJ);**
- **1 mark for managing guarantee on Equity portfolio difficult and costly, taking up more of management's attention (SJ);**
- **1 mark for anti-selection by informed investors exploiting opportunities (CJ);**
- **1 mark for run on the fund and resulting instability as regards liquidity (CJ);**
- **1 mark for impact of transfers/switches on unit pricing/intra-day/forward vs. backward (SJ);**
- **1 mark for guarantee viewed as inconsistent leading to confusion/complaints (CJ);**
- **1 mark for IT complexity (SJ);**
- **1 mark for complexity may result in more errors & poor checking (CJ);**
- **1 mark for cost of capital (CJ);**
- **1 mark for comparative disadvantage against other 'similar' funds (SJ);**
- **1 mark per valid point, for any other reasonable points made (up to 3);**

to a maximum of 2 marks (KU), 4 marks (SJ) and 2 marks (CJ), to a total of 8 marks. Half marks can be awarded for valid points stated, where quality of explanation is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(b) As related to the Equity option -

(i) Portfolio insurance provided by the investment manager:

- This method relies on the transfer of assets between defensive classes (cash or fixed interest) and risky assets (equity).

- As this fund is a unit linked equity portfolio it would have very little, if any, defensive assets in its mandate, which would make it impossible to manage the guarantee this way without breaching this mandate.
- Conclusion: this method would NOT be suitable for managing the capital guarantee.

Marking guide:

- **1 mark for description of method (KU);**
- **1 mark for mandate issue (SJ);**
- **1 mark for conclusion "NOT suitable", supported by explanation (SJ);**
- **1 mark for any other reasonable point made;**

to a maximum of 1 mark (KU) and 1 mark (SJ), to a total of 2 marks. Half marks can be awarded for valid points stated, where quality of explanation is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(ii) Asset-Liability matching, using modelling tools:

- This method uses the results of a stochastic process being applied to the assets and liabilities of a fund to determine the optimal asset allocation for the fund.
- This method could be used to determine the behaviour of an entirely equity portfolio to allow a value to be estimated for the guarantee, thus allowing the capital required to support the guarantee to be estimated and placed in the fund.
- ALM may allow for quantifying of, and explicitly charging for, the cost of providing the guarantee.
- It would be of little use in managing the guarantee (apart from determining and charging a suitable cost, as mentioned in the previous point) as the asset allocation would be fixed at or almost at 100% equity for this portfolio. This method only works if different asset allocations can be tested.
- Conclusion: this method would NOT be suitable for managing the capital guarantee, other than by determining and applying a suitable charge.

Marking guide:

- **1 mark for description of method (KU);**
- **1 mark for estimate of guarantee amount (SJ);**
- **1 mark for quantifying/charging for cost of guarantee (SJ);**
- **1 mark for little use in managing guarantee/only works if different assets (SJ);**
- **1 mark for conclusion "NOT suitable", supported by explanation (SJ);**

to a maximum of 1 mark (KU) and 1 mark (SJ), to a total of 2 marks. Half marks can be awarded for valid points stated, where quality of explanation is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(iii) Rolling options purchased by the company

- The method of choosing the exercise price is a good approximation of the floor value of assets.
- There would be costs involved in the regular option positions, but fees charged could cover these.
- This method would be expected to be expensive, as the options would have to be purchased each and every quarter on an ongoing basis.
- The exposure of the portfolio is adjusted without the need to hold assets other than equities – hence there would be no mandate issue.
- The floor is effective and flexible in providing the guarantee, as it can be adjusted each quarter.
- The options are readily available.
- An alternative may be to buy options of appropriate term, but this may prove much more costly, less effective, and options may not be readily available in suitable form and/or volume.
- The issue would be about the closeness of the matched position between the portfolio and the market index, which could lead to small breaches in the guarantee that would require shareholder support. Such "mismatches" will operate both ways, with the company bearing cost, or enjoying benefit, as the mismatch turns out to be adverse, or beneficial, respectively.
- Conclusion: this method WOULD be suitable for managing the capital guarantee.

Marking guide:

- **1 mark for good approximation of guarantee (SJ);**
- **1 mark for costs but recoverable by fees (CJ);**
- **1 mark for expected to be expensive (SJ);**
- **1 mark for no mandate issue (SJ);**
- **1 mark for quarterly adjustment gives flexibility (CJ);**
- **0.5 mark for options readily available (SJ);**
- **1 mark for alternative may be possible, but has associated issues (CJ);**
- **1 mark for matching could result in small breaches/differences both ways (CJ);**
- **1 mark for conclusion "SUITABLE", supported by explanation (SJ);**

to a maximum of 2 marks (SJ) and 2 marks (CJ), to a total of 4 marks. Half marks can be awarded for valid points stated, where quality of explanation is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

QUESTION 5 **(17 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	2,7,8,9,10,14	2	4		6
Part b)	2,7,8,9,10,14	2	4		6
Part c)	2,7,12, 14			5	5
Total		4	8	5	17

Question

You are an actuary working in the individual risk product division of a very large life insurance company operating in an industrialised country.

You are in the process of profit testing a new series of the current YRT product. This product covers death from any cause up to age 70. The profit testing results have been reproduced below, and represent the profit margin expressed as a percentage of the present value of premiums received:

	Sum Insured range				
Age band	**≤200,000**	**200,001 – 400,000**	**400,001 – 750,000**	**750,001+**	**Weighted average**
≤30	**8%**	**6%**	**5%**	**2%**	**6%**
31 – 40	**11%**	**18%**	**18%**	**16%**	**16%**
41 – 50	**13%**	**20%**	**19%**	**16%**	**19%**
51+	**12%**	**16%**	**16%**	**14%**	**16%**
Weighted average	**11%**	**17%**	**18%**	**15%**	**17%**

The company has sufficiently large experience that a separate pricing basis could be set for each cell in the table above, although the product has not been priced this way to date.

The company's required minimum overall profit margin is 16.5%.

(a) Analyse the results of the ≤30 cohort, giving possible reasons for the results.
(6 marks)

(b) Analyse the overall results, giving possible reasons for the results.
(6 marks)

(c) Identify the sales and marketing issues raised by these profit-testing results.
(5 marks)

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QUESTION 5: SOLUTION (17 marks)

(a) Analysis of results for ≤30's:

- The results for this cohort are distinctly lower than those for the other age bands.
  - One possible reason for this is the effect of an accident hump in the mortality table having been smoothed in the premium rates.
  - Another possible reason is higher lapses in the profit testing basis for this age band, compared with the premium rating basis.
  - It may reflect a deliberate strategy to compete for business at these ages by adopting "market average premium rates" (or rates pitched "aggressively" relative to those of one or more major competitors in the market).
- The results are generally higher for lower sums insured in this age band.
  - One possible reason is the affordability of premiums for larger sums insured leading to a higher lapse rate in the profit testing basis for this age band, compared with the premium rating basis.
  - Another possible reason is that there is anti-selection on higher sums insured that is taken into account in the profit testing basis but not the premium basis. Indeed, anti-selection could result in worse experience for this group as a whole, with the effect being more marked as sum insured increases.
  - The increasing costs of underwriting as sum insured increases may not be fully reflected in the pricing, so that relative profitability declines as sum insured increases.
  - Profit margins might be calculated as a dollar amount which, when divided by an increasing value of premiums, results in a decreasing percentage margin.
  - Another possible reason is that a large sum insured policy for a younger person may be for a specific purpose – to cover a debt, keyman insurance – the circumstances may change in the short term, thus resulting in higher lapses in the profit testing basis relative to the premium rating basis.
- The profitability for this cohort (6%) is well below the overall target rate (16.5%) and arguably the product should not be sold by the company in this cohort, or the premium rates at these younger ages need to be increased.

Marking guide:

- **0.5 mark for lower than other age groups (KU);**
- **1 mark for reason of smoothed accident hump effect (SJ);**
- **1 mark for reason of higher lapses in profit testing basis (SJ);**
- **1 mark for reason of average/aggressive premium rate setting (SJ);**
- **0.5 mark for higher at lower sums insured [or reduces as sum insured increases] (KU);**
- **1 mark for reason of affordability impact on lapse rates (SJ);**
- **1 mark for anti-selection effect on higher sums insured (SJ);**
- **1 mark for increasing underwriting costs not allowed for in pricing (SJ);**
- **1 mark for profit margins calculated as dollar amount (SJ);**
- **1 mark for reason of specific purpose for large cover changing, resulting in higher lapses assumed in profit testing basis as sum insured increases (SJ);**
- **1 mark for profitability well below target range (KU);**
- **1 mark per valid point, for any other reasonable points made (up to 2);**

to a maximum of 2 marks (KU) and 4 marks (SJ), to a total of 6 marks. Half marks can be awarded for valid points stated, where quality of analysis is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(b) General analysis of overall results:

- Overall, the product only just meets the minimum profitability criterion (total weighted average of 17%, cf. required minimum of 16.5%).
- Looking at the 16 cells in the table, only four of them meet required minimum profit of 16.5% (ages 31 – 50 AND sums insured of 200,001 to 750,000). That leaves 12 out of 16 "cells" that fall short of min 16.5% by varying degrees.
- Given the overall result, the assumed mix of business must be heavily weighted to these bands and ranges.
- By age bands, this criterion is only met in the 41 – 50 year old age band, based on weighted average for each age band (41 – 50 is OK at 19%, while others fall short of 16.5%. Although two cells are OK in the 31 – 40 band, that band as a whole falls short.). It therefore depends on weightings assumed for each age band across sum insured ranges, as the lowest SI group is always below target profit.
  - One possible reason for the age band results is the different respective shapes (by age) of the premium rate table and the underlying mortality table which has been used in the profit testing assumptions.
- By sum insured ranges, the product is only profitable for sums insured between 200,001 and 750,000, based on weighted average for each sum insured range (the two middle ranges are OK at 17% and 18%, while the lowest and highest fall short of 16.5%).
  - One possible reason for the lower profit in the low sum insured range is that the expense split between fixed and variable results in too high a loading for fixed expenses in the profit-testing basis, relative to premium rates, for policies at or under 200,000.
  - A possible reason for the lower profit in the high sum insured range is a higher level of lapses in the profit testing basis for this age band, compared with the premium rating basis resulting in lower profitability.
- It is also possible that the mortality for higher sums insured is higher in the profit testing basis, relative to premium rates, than for lower sums insured.
  - A possible reason for this could be the differential mortality at higher sums insured due to anti-selection.
- As the basis is set for each cell in the table, it is possible that there is statistical aberration occurring at the very high sums insured or in other cells where there are thinner business volumes.

Marking guide:

- **0.5 mark for just meets profitability overall (KU);**
- **1 mark for only four out of 16 cells meet required profit – 12 fall short (SJ);**
- **1 mark for mix of business must be weighted towards these cells (SJ);**
- **1 mark for only 41 – 50 year age band actually meets criterion (KU);**
- **1 mark for reason of different shape mortality and premium tables (SJ);**
- **1 mark for only 200,001 - 750,000 sum insured ranges meet criterion (KU);**
- **1 mark for reason of fixed expenses for lower sums insured (SJ);**

- **1 mark for reason of lapses for higher sums insured (SJ);**
- **1 mark for mortality at higher sums insured is higher in profit test basis (SJ);**
- **1 mark for reason of mortality differential due to anti-selection (SJ);**
- **1 mark for statistical aberration with less statistically reliable experience (SJ);**
- **1 mark per valid point, for any other reasonable points made (up to 2);**

to a maximum of 2 marks (KU) and 4 marks (SJ), to a total of 6 marks. Half marks can be awarded for valid points stated, where quality of analysis is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(c) Sales and marketing issues:

- The product is only marginally above the company's required minimum overall profit margin, and only above the required minimum in certain sections, therefore there is currently cross-subsidisation between different groups of the business as implied in the differentials between the profit testing basis and the premium rates.
- This results in a reasonably small "acceptable" target market for this product, being the 31 to 50 year olds with between 200,001 and 750,000 sum insured.
- If more business than expected were sold outside this target area, then overall profitability would be adversely affected by way of shortfall below the company's required minimum overall profit margin.
- Given the weighted average results, it appears that the new business assumptions in use already assume that little business is sold outside this target area.
- There is a large strategic/business risk in this, as such a high concentration in these age/sum insured groups would be difficult to engineer and easy to violate. Even if it were possible to focus business in these groups, strategically that would represent a narrow business focus.
- Thus the premium rates should probably be increased, particularly in the unprofitable segments. An alternative but similar approach may be to introduce (or increase the level of) a policy fee, which would have greater impact at lower ages and lower sums insured – which are some of the 'problem' areas. Another option may be to introduce (or review/increase the level of) a minimum sum insured. There may be strategic reasons why the company chooses not to do any or all of these possible actions.
- Any of the above may assist with target marketing, but may also affect overall new business levels adversely. The sales and marketing business strategy may need to be reviewed so that much higher levels of new business can be achieved, resulting in better coverage of fixed costs and hence improving profitability.
- Sales and marketing analysis may also focus on competitor premium tables, to see if any anomalies are evident in the company premium rates. This may identify points where current and/or proposed rates are "out of the market".

Marking guide:

- **1 mark for cross-subsidisation;**
- **1 mark for small target market;**
- **1 mark for adverse experience if growth outside acceptable target market;**
- **1 mark for weighted average indicates assumed concentration in target market;**
- **1 mark for large strategic/business risk in high concentration;**

- **1 mark for premium rates should increase, and/or similar strategies;**
- **1 mark for assist target marketing, but may reduce sales overall – review strategy towards increasing business levels generally;**
- **1 mark for review competitor premiums;**
- **1 mark for any other reasonable point made;**

to a maximum of 5 marks (CJ). Half marks can be awarded for valid points stated, where quality of supporting commentary is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

QUESTION 6 **(17 Marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part (a)	8, 9, 14	2			2
Part (b)	2		2		2
Part (c)	2, 3, 4, 7		5		5
Part (d)	2, 7			4	4
Part (e)	8, 9, 14			4	4
Total		2	7	8	17

Question

You are the pricing actuary for Any Way Life, a life company that sells a range of individual risk insurance products including Disability Income Insurance (DII).

You are about to re-price your DII product and therefore need to reset the morbidity basis. No significant changes have occurred to the product or its terms and conditions.

The valuation results have been provided to you. These are as follows:

Morbidity Results	Actual/ Expected (A/E)	A/E as a %
Incidence (claim numbers)	**58/57.9**	**100.17**
Termination (claim numbers)	**51/53.2**	**95.86**
Claim payments ($'000)	**1,909/2,291**	**83.32**

In view of the nature of these results, you have made further investigations into the morbidity experience and found that in the final 2 months of the year the company made no actual claim payments, even though the actual number of claims recorded as "active claims in the course of payment" was within 5% of the expected number over that period, and indeed over the whole year.

The actual experience has been very close to that expected from the pricing assumptions (including profit margin) over the 3 years prior to this event occurring.

(a) Allowing for the actual incidence and termination results above, what would you have expected the approximate claim payment amount to be for the year?
(2 marks)

(b) What other reasons (apart from any non-payment of claims) might have contributed to the low level of claim payments in the table above?
(2 marks)

(c) What possible consequences would the company be exposed to if it is discovered that company errors have caused significant non-payment of claims?
(5 marks)

(d) Suggest mitigation and management strategies that would help prevent such an event from occurring in the future. (4 marks)

(e) Considering the past 3 years of experience, why may you wish to re-price this product? (4 marks)

QUESTION 6: SOLUTION (17 Marks)

(a) On the simplest approach, expected claims of 2,291 are grossed up for higher incidence of 100.17% and adjusted for lower termination of 95.86%. Approximately, then –

Claims would be expected to be around 2,291 x 1.0017 / 0.9586 = 2,394 (in $'000)

Clearly, the starting point is Expected of 2,291. Without doing any calculation, one could suggest that as both measures (incidence & termination) have been adverse, the adjusted expectation is "slightly higher than Expected", say 2,300.

As the A/E for each (incidence & termination) has emerged over the year, their respective impacts on claims payments may be expected to operate for half a year on average. On this approach –

Claims would be expected to be around 2,291 x 1.00085 / 0.9793 = 2,341 (in $'000)

While there is not enough information to be too precise, the point of the question is that from the above starting point, and allowing for known variance in both measures (incidence & termination), a higher figure would have been the adjusted expectation – hence the observed actual of 1,909 is highly irregular.

Marking guide:

- **0.5 mark for appropriate adjustments that "allow for incidence and termination";**
- **0.5 mark for calculations, setting out, etc;**
- **0.5 mark for explanation that accompanies calculations;**
- **0.5 mark for an adjusted expected figure in the range 2,300 to 2,400;**
- **0.5 mark for any other reasonable comment, e.g. "not enough information";**

to a maximum of 2 marks (KU).

(b) The other reasons that might have contributed to the low level of claim payments include:

- Over the year, the number of claims being paid was within 5% of the expected number but the benefit amounts have been for lower levels than expected (e.g. more than expected numbers of smaller claims, along with fewer than expected numbers of larger claims) – hence average claim amount may have been 10% lower than expected.
- The claims department may have been targeting high benefit level claimants for termination, thus terminations have been the same in number but with a greater emphasis on larger amounts - hence a much greater financial effect.

- A greater number of partially working claimants (where partial claims result in offset of benefits paid), thus lower amount in payment for same number of claims. Similarly, there may be claims where "offset" clauses are operating.
- There may have been some significant catching up of reinsurance recoveries on claims.

Marking guide:

- **1 mark for lower average claim amounts;**
- **1 mark for targeting larger terminations/financial effect;**
- **0.5 mark for partial benefits, or similar valid explanation;**
- **0.5 mark for reinsurance recoveries;**
- **0.5 mark for any other reasonable point made;**

to a maximum of 2 marks (SJ).

(c) The possible consequences that the company would be exposed to if it is discovered that company errors have caused significant non-payment of claims include:

- Reputation – policyholder aspect: knowledge of this issue in the wider market would damage the reputation of the company (particularly if the media are involved – and they probably would be). This is likely to have flow-on effects of increasing lapses and reducing new business.
- Reputation – shareholder aspect: incorrect reporting would result in adjustments being required to opening figures in the current year's accounts. Credibility is easily lost with shareholders and analysts when this occurs. This includes possible impact of error on profit/EV numbers reported in the past. That may lead to "opening adjustments" which can be a nuisance. Moreover, the EV may be impacted again for assumption changes.
- Regulatory: it is not unreasonable that the regulator would be concerned for the sound running of the company, and would be likely to become more involved in company affairs and request information – all of which is costly and time consuming.
- Damages: as the company would have breached its contracts to clients, they may have claims for damages if the non-payment has resulted in them incurring additional costs.
- Legal costs: even if no damages claims are sustained, there may be legal costs involved in defending any claims.
- Administration expense: The cost of investigating and correcting the situation, with the additional checking involved, would be significant.
- Management expense: The cost of time taken by management in sorting out the situation, dealing with the regulator, media, clients, advisers and the distraction from other possibly more important strategic business and company issues.

Marking guide:

- **1 mark for reputational damage with policyholders;**
- **1 mark for reputational damage with shareholders;**
- **1 mark for regulatory involvement;**
- **1 mark for damages;**
- **1 mark for legal costs;**
- **1 mark for admin expense;**
- **1 mark for management expense and/or focus distraction;**

– **1 mark per valid comment, for any other reasonable comments made (up to 2);**

to a maximum of 5 marks (SJ). Half marks can be awarded for valid points stated, where quality of supporting commentary is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(d) Mitigation and management strategies that would help prevent such an event from occurring in the future include:

- Monthly reporting of data on claims numbers and payments in detail, by product group – will allow management to identify the issue more readily, as well as prompting the admin areas to keep on top of their own work.
- Reporting expected and actual numbers of claim payments, as well as by amount – will allow management to pick up variances, or suspicious/unexplained trends.
- Such an incident, once having occurred, would be included for closer scrutiny as part of the external audit process. This may be augmented by targeted internal audit focusing on the known and/or potential problem areas.
- Improving the processes in the Claims area:
  - Weekly checks on the numbers of claims due for payment and the number of payments actually made.
  - Identification of the state of each claim, by each claim manager, by an easy-to-see or readily obtainable information method – e.g. ability to take data from claims system, indicating when claim worked on and what done.
  - Implementation of regular reporting of main items of work for the Head of the Claims department.
  - Checklist for claims managers of main aspects of their role, including procedures for covering in the event of staff leave, illness, etc.

Marking guide:

– **1 mark for monthly reporting;**
– **1 mark for number of payments and/or amounts;**
– **1 mark for external and/or internal audit;**
– **1 mark for weekly check;**
– **1 mark for identification system;**
– **1 mark for regular reporting to Head of department;**
– **1 mark for checklist for claims managers;**
– **1 mark per valid strategy, for any other reasonable strategies given (up to 2);**

to a maximum of 4 marks (CJ). Half marks can be awarded for valid points stated, where quality of supporting commentary is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

(e) Reasons for re-pricing the product:

- The recent issue is serious and may have a large effect on future assumptions that may or may not have been taken into account in past data – it throws some doubt over the

general integrity/reliability of results, certainly in the current period, and possibly in the previous periods.

- Competition – the market may be more or less competitive than previously thought and thus premium rates might be reduced or increased accordingly (Thus the profit margin would alter accordingly, as market share comes under increasing pressure).
- The profitability requirement of the shareholders may have changed, thus more or less profit may be required from the product.
- The mix of business sold may not be producing the profit required, so some sections of the rates may need to be altered to attract the right business mix to support ongoing profitability.
- Insufficient capital may be available to support the strain of this business and thus sales may need to be restricted or provide a greater return to attract more capital.
- The company may wish to take into account management actions in improving the results, for example more active claims management that results from correcting this issue may be expected to improve experience.
- Expected future experience may be different, e.g. incidence, termination, expenses, interest, etc. as compared with when product was last priced.
- Company may wish to change product design, target a different market, etc.

Marking guide:

- **1 mark for taking recent issue into account/degree of uncertainty;**
- **1 mark for competition;**
- **1 mark for changed profitability requirement;**
- **1 mark for mix of business;**
- **1 mark for insufficient capital;**
- **1 mark for different future experience expected;**
- **1 mark for change product design, etc;**
- **1 mark per valid reason, for any other reasons given (up to 2);**

to a maximum of 4 marks (CJ). Half marks can be awarded for valid points stated, where quality of supporting commentary is missing or less substantial (i.e. where half mark is judged more appropriate than none at all), or to differentiate answers of different quality.

END OF SOLUTIONS