INSTITUTE OF ACTUARIES OF AUSTRALIA

2A LIFE INSURANCE **APRIL 2008 EXAMINATIONS**

Marking Guide

Level of difficulty.

Question	Syllabus Aims	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1a)	16		2		1	3
1 b)	16		2			2
1c)	5			2		2
1 d)	1,12				4	4
1 e)	4,5			4		4
1 f)	6				3	3
2 a)	9		3			3
2 b)	3,4,5			3		3
2 c)	12,14		2	4	2	8
2 d)	8				3	3
3 a)	5		4			4
3 b)	4,5,13			4		4
3 c)	5,7			3	1	4
3 d)	5				2	2
3 e)	5,13		2			2
4 a)	7		4			4
4 b)	7			3		3
4 c)	3		1	2		3
4 d)	2			2	3	5
5 a)	4,6			3		3
5 b)	6,11			3		3
5 c)	8,9			4		4
5 d)	1,3				3	3
5 e)	1,12				4	4
6 a)	1,3			3		3
6 b)	3,4,6,7				7	7
6 c)	3,4,6,7				7	7
Total			**20**	**40**	**40**	**100**

QUESTION 1 **(18 marks)**

Analysis

Component	**Aim**	**KU**	**SJ**	**CJ**	**Total**
Part a)	16	2		1	3
Part b)	16	2			2
Part c)	5		2		2
Part d)	1,12			4	4
Part e)	4,5		4		4
Part f)	6			3	3
Total	**1,4,5,6,12,16**	**4**	**6**	**8**	**18**

Your Head of Marketing claims the time is right for the return of traditional participating insurance products in Australia. He thinks that, with the volatile stock market condition, the financial crisis and the economic recession looming in the US, customers will appreciate the long-term stability of traditional participating products more than ever.

Draft an issues paper, addressed to the Head of Marketing, in which you:

a) **List the key attributes that the Appointed Actuary would consider for a bonus or profit sharing system.** **(3 marks)**

b) **State the steps the company should follow in declaring reversionary bonuses in a financial year.** **(2 marks)**

c) **Identify how underwriting for traditional participating products could differ from Yearly Renewable Term products for the same sum insured.** **(2 marks)**

d) **Discuss the advantages and disadvantages of traditional participating products for a policyholder.** **(4 marks)**

e) **Explain the major risks to the company in writing traditional participating products.** **(4 marks)**

f) **Discuss how the investment strategy for traditional participating products would be different from those for investment-linked and for lifetime annuity products.** **(3 marks)**

QUESTION 1: SOLUTION **(18 marks)**

(a) (3 marks)

To: Head of Marketing
Date: xx April 2008

Issues Paper: Traditional Business

It has been proposed that the current financial environment is conducive to the reintroduction of traditional participating insurance products to the Australian market. This paper canvases a number of issues arising in respect of this proposal.

Key attributes for a bonus or profit sharing system
To be acceptable to all stakeholders, a bonus or profit sharing system will need to demonstrate the following attributes:

- Equitable: It should be fair between different classes of policy holders.
- Smooth: It is generally expected that bonus declarations should be stable from year to year.
- Sustainable: Flowing from this the bonus declared should be close to that which can be supported over the long term.
- Competitive: It is desirable for bonus declarations to be at a level which is regarded as being competitive with market alternatives.
- Legally compliant: Australian life insurance law limits distributions to shareholders as a proportion of the value of distributions to policyholders.

Marking guide:
½ mark for each characteristic as above;
½ mark for each other valid characteristic;

To a maximum of 2 marks KU; plus

1 mark CJ for appropriate formatting and language for an issues paper.

(Note that while this 1 mark CJ is allocated to part (a) of the question, it should only be granted if appropriate language and formatting are used throughout the entire answer for Question 1.)

(b) (2 marks)

Procedure for Declaring Bonus / Profit Shares in a Financial Year
The following steps will typically need to be followed each year to effect the declaration of bonuses or the distribution of profit shares:

- Group the in-force book into cohorts with similar characteristics, such as:
  - related classes of business;
  - risks covered;
  - in-force duration;

  - profit experience; and
  - reversionary bonus structure (eg. normal or super compound).

- Determine the asset share attributable to each group (usually Value of Supporting Assets plus Policyholder Retained Profits).

- Determine the earnings for each group for the year.

- Determine the supportable bonus rate for each group.

- Determine the declared bonus rate for the year for each group with reference to:
  - The stated bonus declaration policy
  - The supportable bonus rate
  - Competitor rates
  - Earnings of other "comparable" investment opportunities in the market
  - The historical and expected future trend in bonus rates (i.e. any reserve which needs to be held for future smoothing).

- For cancellations/maturities/claims within the next financial year, the company will also need to declare interim bonus rates to be used until the next bonus rates declaration.

Marking guide:
½ mark for grouping of business into related cohorts for analysis;
½ mark for asset share calculation;
½ mark for supportable bonus/bonus sustainability;
½ mark for consideration of stated bonus declaration policy;
½ mark for market competitiveness re competing life offices;
½ mark for market competitiveness re other investment vehicles;
½ mark for consideration of historic rates/potential future rates/smoothing;
½ mark for interim bonus rates;
½ mark for each other valid point;

To a maximum of 2 marks KU.

(c) (2 marks)

Underwriting for Traditional Products
Traditional products generally require less medical underwriting:

- Traditional products typically have higher premiums for the same levels of cover relative to term insurance. This arises largely from the loadings included in the premiums for future bonuses, but also arises because premiums are level rather than stepped with age. Higher premiums deter anti-selection, as it is cheaper to anti-select against a term insurance cover.
- Policyholders share in 80% of the mortality experience of the traditional business, so the office has less incentive to underwrite as strictly.
- Sum at risk decreases, or increases more slowly than for a term insurance, due to the build up of the reserve.

Traditional products generally require:

- Less financial underwriting to determine the need for the sum insured;
- More financial underwriting to determine the long term affordability to customers of such saving.

Marking guide:
1 mark for less medical underwriting with valid explanation;
1 mark for financial underwriting with valid explanation;

To a total of 2 marks SJ.

(d) (4 marks)

<u>Typical Advantages Claimed for Traditional Products</u>

- They provide a mix of saving, investment, and protection elements, which provide customers with bundled packages to meet their financial service needs.
- They provide a minimum guaranteed return which will be valuable in times of market downturns.
- They give stable returns in fluctuating market conditions where investment returns may be very volatile.
- The premium is generally guaranteed at inception, which protects the customers from future inflation / mortality downside.

<u>Typical Disadvantages Claimed Against Traditional Products</u>

- Their "bundled" nature is perceived as not being transparent, hard to understand, or even expensive.
- Surrender values are not attractive in the first few policy years. The company is perceived as taking money from the customers who leave.
- In a bull market environment, traditional participating products are often outperformed by investment linked products with aggressive investment policies.
- Because of their long term guaranteed nature, traditional products are sometimes priced conservatively, and they are not seen as competitive against yearly renewable products.

Marking guide:
Note: The answer to this question may vary depending on what the student is comparing traditional products to. Some leniency should be allowed on the extent of possible answers, provided points are supported by adequate reasoning.

1 mark for each advantage as above with adequate reasoning;
1 mark for any other valid advantage (with reasons);

To a maximum of 2 marks CJ; plus

1 mark for each disadvantage as above with adequate reasoning;
1 mark for any other valid disadvantage (with reasons);

To a maximum of 2 marks CJ.

(e) (4 marks)

Major Risks for the Company to Consider

- Operational risk: traditional products, especially surrender value and bonus features, are generally complicated to administer.
- Scale risk: for a small company / small portfolio of participating products, profit sharing may result in fluctuating bonus rates.
- Reputational risk: if for some reason the company is unable to meet policyholders' expectations (reasonable or otherwise), its brand could be damaged. The complexity of the product increases this risk.
- Lapse risk: traditional products are long term capital intensive products, with a break even period usually after 3-5 years. If lapses are significant in the first few policy years, the company stands to make a loss. Although this loss is shared with policyholders, there may be limits to how much can be passed on.
- Investment / interest risk: the investment yield / interest assumed at pricing will most likely be different from actual yield / interest. If the actual return is significantly lower than expected, the loss can be larger than can be shared with policyholders.
- Market risk: because of the need to invest into growth assets to match competitors, the products are more exposed to market default risks.
- Insurance risk: because of its long term nature, the mortality assumption made at pricing stage may not be sufficient to cover future mortality experience. While most of this risk is passed on to policyholders in the form of reduced bonuses, the company stands to make a loss if experience turns out significantly worse than expected.
- Expense / inflation risk: future expense and inflation rates on expense assumptions are hard to predict over the long term of the contract. Because this risk is shared with policyholders, it should only have a significant impact on a life office where there is a lack of scale – a small volume of business supporting significant overheads.

Marking guide:
1 mark for each risk as above, identified and explained;
1 mark for any additional valid point with appropriate explanation;

To a maximum of 4 marks SJ.

(f) (3 marks)

Investment strategy for traditional par product vs investment linked and lifetime annuity

For investment linked business, the policy holders take the investment risk. The policy holder money is invested according to the investment choice selected. The shareholder money is mostly invested in conservative / cash options.

For lifetime annuity business, the company guarantees the lifetime income, and takes all of the investment risk. The investment strategy for the policyholder fund is generally conservative with the majority of the investment into fixed income and stable assets (property trust, share with guaranteed dividends), closely matching the liability cashflows.

For the traditional participating product, the company provides a minimum guaranteed rate of returns, and shares the upside of investment return with the policyholders. The policyholder money is invested into a balanced portfolio with a long term stable growth focus (a mixture of cash, bond, and growth assets such as equity). The key objective is to produce an attractive return over the long run, although there is still a short term solvency / capital adequacy requirement leading to a need to pay some attention to asset/liability matching.

As part of the capital required to support participating business is provided by policyholders, more risks can generally be taken in the investment strategy.

Marking guide:
1 mark for each product's investment strategy mentioned with valid discussion;

To a total of 3 marks CJ.

QUESTION 2 **(17 marks)**

Analysis

Component	**Aim**	**KU**	**SJ**	**CJ**	**Total**
Part a)	9	3			3
Part b)	3,4,5		3		3
Part c)	12,14	2	4	2	8
Part d)	8			3	3
Total	**3,4,5,8,9,12,14**	**5**	**7**	**5**	**17**

You are an actuary working in Australia. Your company, Life Adventurer, is venturing into group life insurance, a market segment the company has stayed away from until now.

Your first potential customer is FTA (Free Tigers Association), a group of volunteers dedicating their free time to freeing all tigers held in captivity. Their activities include lunch time demonstrations, lobbying, and sometimes staging hunger strikes inside tiger cages. Their cause is gaining momentum, with more than 10,000 new members in Australia annually. FTA is looking to provide free death cover to members as a means to boost members' loyalty, with slogans like "Free Tigers Free Insurance". The insurance cost will be paid for by FTA out of their membership fee revenue.

Your Head of Product thinks this is a wonderful opportunity, not only for the new business volume, but also for the good publicity it will generate for Life Adventurer, and future potential cross-sells to this customer base. He went as far as hinting he's willing to take very little profit on this deal. It is down to you to make it work. It should be noted that FTA is entering into negotiations with three different insurers at once. Pressure is high.

a) **To set mortality assumptions for this group:**
- **List the sources of information you would rely on.**
- **Outline the steps you would take.**

(Note your own and your company's lack of group life experience).

(3 marks)

b) **During the first meeting, FTA representatives expressed very strongly that the cover should have no underwriting requirement and as few exclusion clauses as possible. They wanted a clean and simple cover for their members. List the eligibility conditions & exclusion clauses you think are necessary for this group, with a brief explanation for each.**

(3 marks)

c) **Having reviewed your estimated premium breakdown (table below), your Head of Product is still convinced he could only pitch the offer at $13.5**

per month per member. In fact, he overheard a major competitor would offer cover at $12.95 per month per member, well below your proposed premium of $15. He confesses he only hopes to win on Life Adventurer's quality of service and 'a very good relationship with the Head of FTA'.

Premium Breakdown	$ per month per member
Claim cost	12.2
Variable expense	0.9
Fixed expense	0.5
Expected margin	1.4
Total premium	15.0

Note: the cover has a moderate sum insured on a sliding scale such that the premium is the same across different ages and genders.

Explain to your Head of Product:

i. **The possible reasons why the major competitor is able to quote a lower premium than yours. (2 marks)**

ii. **The concepts of "marginal pricing" and "full costing", relating your answer to the breakdown table above. (2 marks)**

iii. **The advantages and disadvantages of "marginal pricing" and "full costing", and indicate with reasons the method you would advocate for this deal. (4 marks)**

d) **The Head of FTA is interested in your quote. He hints that Life Adventurer may win the deal if you are willing to fix the premium for 5 years, with the option to increase the premium in the first 5 years only in an 'adverse claim experience' situation. Draft a possible definition of 'adverse claim experience' to be proposed to FTA. (3 marks)**

QUESTION 2: SOLUTION **(17 marks)**.

(a) (3 marks)

Sources of information:

1. Mortality experience from the company (note difference between current business experience and expected experience of group life).
2. Mortality study reports from the IAAust.
3. Industry research from consulting firms on group life mortality.
4. Information and quotations from the reinsurers.
5. Advice from group life consulting actuaries.
6. Current and projected membership profile of the group, including details such as gender, age, occupations.

Steps to set mortality assumption:

1. Start from the Australian insured lives ultimate mortality table, or Australian general population mortality table. The latter of which could be more appropriate in this case.
2. Make adjustments to allow for the group life business profile (occupation class average, number of members, diversity of membership, automatic cover, level of cover).
3. Adjustments are not required for selection (as the entire membership will be covered), or for hazardous activities (e.g. hunger strikes in tiger cages) (as these activities will incur exclusions).

Marking Guide:
½ mark for each source of information;

To a maximum of 2 marks KU; plus

½ mark for each step in setting mortality assumption;

To a maximum of 1 mark KU.

(b) (3 marks)

The following eligibility conditions are important for the FTA Group:

- Cover commences upon starting membership and paying membership fee, and ceases as soon as membership is terminated for whatever reason. This is so the company can determine the level of risk exposure.
- If members reinstate membership later, the cover can be reinstated but the exclusion clauses will start again. This is to limit anti-selection risk.
- Full cover is available 12 months after commencement / reinstatement. In the first 12 months, only a fraction of the cover (eg. premium refund) is payable. This is to limit anti-selection risk.

The following exclusions are important for the FTA Group Life:

- Pre-existing conditions before joining the group life scheme. To limit anti-selection and uninsurable risks.
- Death due to self-inflicted causes / suicide, to limit anti-selection.
- Death while involved in specified hazardous activities – hunger strikes in tiger cages.
- Death while involved in illegal activities (eg. breaking and entering), again to limit the risk of anti-selection.

Marking guide:
½ mark for each point on eligibility as above;
½ mark for each other valid point;

To a maximum of 1.5 marks SJ; plus

½ mark for each exclusion clause as above;
½ mark for each other valid exclusion;

To a maximum of 1.5 marks SJ for exclusion clauses.

Note to Markers: Some standard exclusion clauses may be suggested e.g. war, death overseas. As there are several exclusion clauses that are relevant (and necessary) to the particular product under consideration, and thus multiple ways to earn the available marks, marks should not be awarded for suggested general exclusion clauses.

(c) (8 marks)

(i) (2 marks)

1. The competitor may assume a lower claim cost for this group of business.
2. The product's terms and conditions may be different, which leads to lower claim cost.
3. They may have the scale to absorb higher-than-expected claim costs and / or spreading the loss with other profitable group business.
4. They may have access to cheaper reinsurance rates, and pass on this saving to group members.
5. They may have lower expense overhead thanks to scale / effectiveness in administration.
6. They may be doing marginal pricing with very thin contribution to overheads and profit.
7. They may simply be willing to sell a loss-leading group scheme for strategic reasons.

Marking guide:
½ mark for each point as above;
½ mark for any other valid point;

To a maximum of 2 marks CJ.

(ii) (2 marks)

1. Full costing refers to the pricing approach where premium is sufficient to cover expected claim costs, variable expense, allocated overheads, and expected profits.
2. Marginal pricing refers to the pricing approach where premium is sufficient to cover expected claim costs and marginal expense, leaving a surplus to contribute towards overheads and company profits. While this surplus may not be enough to cover the allocated overheads, it may still be better than nothing.
3. In the table above, a premium of $15.00 will be sufficient to cover all claim costs and expenses, plus an expected profit margin. This is the fully costed premium.
4. On the other hand, a premium of $13.10 or above will be sufficient to cover claim cost ($12.20) and variable expense ($0.90), leaving the company with a surplus to contribute towards overheads and company profits. This is marginal pricing.

Marking guide:
½ mark for valid definition of "full costing";
½ mark for valid definition of "marginal pricing";
½ mark for numerical example referring to the table, which shows a good understanding of "full costing";
½ mark for numerical example referring to the table, which shows a good understanding of "marginal pricing";

To a total of 2 marks KU.

(iii) (4 marks)

Full costing:

Advantages:
- Fully accountable for all cost items and expected profit margin.
- Correctly reflects the product's profitability, after all allocated expense.

Disadvantages:
- May result in expensive premiums, especially if the allocated overheads are heavy (for newly established or small companies).
- Requires overhead expenses to be allocated fairly to all product lines, which is sometimes hard to achieve.
- Inflexible in competitive environment where company wants to gain market share with cheaper pricing.

Marginal pricing:

Advantages:
- Only need to account for all costs directly associated with the product, which will enable the premium to be lower.
- May still contribute to overheads and company's profit.
- Competitive pricing may lead to higher level of business and opportunity for cross-sell.

Disadvantages:

- May have insufficient contribution to overall company overheads, thus result in overall loss results. This is especially true if the “mainstream” products drop off the book.
- May lead to disagreement between product managers as other products appear to bear an inequitable share of overhead expenses relative to marginally priced product lines.

For this book, as group life business is new for the company, and the FTA may also deliver future cross sell opportunities not priced into the premium, marginal costing may be appropriate in the short term.

Marking guide:
½ mark for each advantage as above;
½ mark for each disadvantage as above;
½ mark for any other valid advantage or disadvantage;

To a maximum of 3 marks SJ; plus

1 mark SJ for any choice of pricing method with valid reasoning.

(d) (3 marks)

<u>A possible definition of “adverse claim experience”:</u>

Adverse claim experience refers to the situation where actual claims are significantly higher than expected claims.

Actual claims are claim amounts incurred in a defined period of analysis, taking into account claims incurred but not reported and claims reported but not yet settled.

Expected claims are claim amounts expected in the defined period of analysis, calculated by applying the claim rates assumed during pricing to the actual exposure during the period.

A threshold of actual to expected claims (eg. 120%) will be defined such that if actual to expected claims is above this level, it is credibly determined that there is adverse claim experience.

Marking guide:
1 mark for mentioning “actual higher than expected”;
1 mark for actual claim definition, mentioning IBNR and RBNA;
1 mark for expected claim definition, mentioning applying pricing assumptions to actual exposure;
1 mark for any other valid point;

To a maximum of 3 marks CJ.

QUESTION 3 **(16 marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	5	4			4
Part b)	4,5,13		4		4
Part c)	5,7		3	1	4
Part d)	5			2	2
Part e)	5,13	2			2
Total	**4,5,7,13**	**6**	**7**	**3**	**16**

Your company is a newly established but fast growing Australian life insurer. The company's reinsurance contract for its individual risk product portfolio (consisting of Yearly Renewable Death cover only) is up for re-tender. The inforce business is locked in with the existing reinsurer. Only future new business cohorts are being considered.

Your CEO plans to reinsure future new business solely with the reinsurer who offers the best deal, from both a profit maximising and a risk management perspective. He asks you to work on the two quotes he has just received from two major reinsurers.

The quotes are:

<u>Reinsurer A:</u>
Surplus arrangement.
Retention limit of $1 million for each life.
Reinsurance premium rates = 80% of your company's premium rates.
Reinsurance commission = 75% of first year reinsurance premium, and zero thereafter.

<u>Reinsurer B:</u>
Quota share arrangement.
Retention level is 40%, ie. your company retains 40% of each risk.
Reinsurance premium rates = 90% of your company's premium rates.
Reinsurance commission = 50% of first year reinsurance premium, and zero thereafter.

Your actuarial analyst has performed or obtained the following analyses:

New Business Profile

Sum Insured Range ($)	Average SI ($)	Proportion by Lives	Proportion by Cover
0-100,000	60,000	20%	3%
100,001-400,000	251,500	35%	22%
400,001-700,000	548,500	35%	48%
700,001-1,000,000	840,000	5%	10.5%
1000,001-1,500,000	1,320,000	5%	16.5%
1,500,001+	0	0%	0%
Total	400,000	100.0%	100.0%

Planned New Business

	Y1	Y2	Y3
Lives	25,000	30,000	40,000
Average SI ($)	400,000	400,000	400,000
Average Premium ($)	380.00	380.00	380.00

3-Year Business Projections

Year	Lives	Ave SI	Ave Prm	Premium Earned PY1 ($000)	Premium Earned PY2 ($000)	Premium Earned PY3 ($000)	Premium Earned Total ($000)	Claim Incurred Total ($000)
1	25,000	400,000	380	9,500	-	-	9,500	4,275
2	52,500	400,000	380	11,400	8,550	-	19,950	8,978
3	87,250	400,000	380	15,200	10,260	7,695	33,155	14,920

Note: for this exercise you should assume:

- **All policies start on the first day of the year.**
- **All lapses occur on the last day of the year.**
- **There are no multiple policies on the one life.**

a) **Estimate the 3-year reinsurance cashflows for each reinsurance quote, stating any further assumptions you make. (4 marks)**

b) **Based on the information provided, assess the suitability of each reinsurance proposal for your company (from both a profit maximising and a risk management perspective). (4 marks)**

c) **Explain the other factors which may influence the company's decision in selecting a reinsurer. (4 marks)**

d) **The CEO indicates that his revised objective is to maximise the stability of future profits while still retaining exposure to potential good claims experience. Propose with reasons a reinsurance arrangement (not limited to the two options above) that should meet this objective. (2 marks)**

e) **The CEO indicates that he now wants a retention level that gives the company a 1-year 1-in-2000 chance of going bankrupt due to insurance risk (a new concept he learnt in a risk management seminar). List the theoretical steps you would take to find this level. (2 marks)**

QUESTION 3: SOLUTION **(16 marks)**

(a) (4 marks)

<u>Surplus Arrangement</u>
Assumptions:

1. Premiums earned are proportional to the sum insured exposures (i.e. there is no large sum insured discount to distort the ratios when calculating surplus treaty exposure).
2. Claims incurred are proportional to the sum insured exposures, i.e. the same mortality experience applies to small and large cases.
3. Future NB matches the expected profile.

Proportion of cover/premium reinsured
= 16.5% x (1,320,000 – 1,000,000) / 1,320,000
= 4.000%

Surplus arrangement	Rein prem ($000)	Rein comm ($000)	Rein claim ($000)	Cashflows ($000)
Year 1	304	228	171	95
Year 2	638	274	359	-5
Year 3	1061	365	597	-99

Example formula:
Rein prem Y1 = 80% x 9,500 x 4.000%
= 304

Rein com Y2 = 75% x 80% x 11,400 x 4.000%
= 274

Rein claim Y3 = 14,920 x 4.000%
= 597

Cashflows Y1 = -304 + 228 + 171
= 95

<u>Quota Share Arrangement</u>
Assumptions:
No additional assumptions required.

Proportion of cover/premium reinsured = 60%

Quota share arrangement	Rein prem	Rein comm	Rein claims	Cashflows
Year 1	5,130	2,565	2,565	0
Year 2	10,773	3,078	5,387	-2,309
Year 3	17,904	4,104	8,952	-4,848

Example formula:
Rein prem Y1 = 90% x 9,500 x 60%
= 5,130

Rein com Y2 = 50% x 10,773 x 11,400 / 19,950
= 3,078

Rein claim Y3 = 14,920 x 60%
= 8,952

Cashflows Y1 = -5,130 + 2,565 + 2,565
= 0

Marking guide:
2 marks for correct calculation of surplus arrangement;
(Up to 1 mark can be given to wrong final result but answer showing correct logic. Rounding differences should not be penalised).
1 mark for correct calculation of quota share arrangement;
1 mark for making valid assumptions for the calculation;

To a total of 4 marks KU.

(b) (4 marks)

Surplus arrangement:
Better from a profit maximising perspective, as it gives higher net cashflows to the insurer. This is a direct result of reinsuring less of the total risk exposure.

Not so good from a risk management perspective as it only covers a very small portion of the risk exposure for the company. As the company is new (presumably small), large exposure to insurance risk is not desirable.

Quota share arrangement:
Not good from a profit maximising perspective, as it reduces the net cashflows of the insurer substantially. It may also incur increased costs overall, from involvement of both the insurer and the reinsurer in the handling of small claims.

From the risk management perspective, the quota share arrangement is better because:

1. This quota share arrangement will reduce the total risk exposure of the company more, resulting in less volatile claim costs.
2. Quota share will enable reinsurer's involvement at all level of case sizes, thus reducing the risk of underwriting / claim handling error.

3. The company is new and fast growing, so capital is probably a constraint. Quota share will reduce the new business capital requirements on the company.

Marking guide:
1 mark for each point of assessment of the surplus arrangement with adequate reasoning;

To a maximum of 2 marks SJ; plus

1 mark for each point of assessment of the quota share arrangement with adequate reasoning;

To a maximum of 2 marks SJ.

(c) (4 marks)

Other factors which influence the reinsurer selection decision:

- Credit rating of the reinsurers, which show their financial strength as well as their risk management competency.
- Reinsurer's capacity to accept risks, or making decisions locally. Strong capacity and local authority will benefit the working relationship.
- Level of services provided in terms of underwriting and claim management. It is important to the insurer to receive informative and timely reviews or decisions on underwriting and claims for major cases.
- Additional services like staff training, product development and market intelligence. These will add value to the insurer.
- Reinsurer's reputation and expertise in certain fields of the insurance market, which may be important to the insurer in its strategic development.
- Other valid points.

Marking guide:
1 mark CJ for credit rating / financial strength of reinsurer; plus

1 mark for each other valid point with proper explanation;

To a maximum of 3 marks SJ.

(d) (2 marks)

Propose:
(a) Surplus arrangement with lower retention (eg. $400,000) OR
(b) A combination of surplus arrangement above $1million and quota share below that level.

Also, propose to have an additional catastrophe arrangement where 10 or more deaths resulting from a single catastrophic event are covered by the reinsurer.

This way the insurer is exposed to a large number of small risks, and limits the loss on any single catastrophic event. The insurer will still gain exposure to the upside in mortality experience. The profit stability will be maximised.

Marking guide:
½ mark for proposing a form of retention for the company that is lower than $1 million;
½ mark for proposing some form of catastrophe reinsurance;
½ mark for any other valid form of insurance proposed;
1 mark for valid reasons supporting the proposal;

To a maximum of 2 marks CJ.

(e) (2 marks)

The following steps are required:

1. Build a stochastic model to randomly project the claim / no claim events of the policies in a single year based on expected mortality rates and standard deviations of the mortality rates of the life insureds.
2. Run the targeted cohort of new business through the model (many times) to come up with the distribution of total net claim costs in a single year. The central estimate of the net claim cost is the expected claim cost in a single year.
3. The deviation from this central estimate (on the right tail) is the adverse claim situation that needs to be supported by the company's capital. We need to find the 99.95 percentile, ie. the 1 in 2000 point where claim cost exceeds capital.
4. Based on the distribution of net claim costs, the amount of capital available to support the adverse claim costs and the cost of reinsurance, we will find a retention level that will result in a 1-in-2000 chance of total net claim costs exceeding the capital level.

Marking guide:
½ mark for mentioning stochastic modelling;
½ mark for mentioning deviation on the right tail (larger than expected claim cost);
1 mark for valid description;

To a maximum of 2 marks KU.

QUESTION 4 **(15 marks)**

Analysis

Component	**Aim**	**KU**	**SJ**	**CJ**	**Total**
Part a)	7	4			4
Part b)	7		3		3
Part c)	3	1	2		3
Part d)	2		2	3	5
Total	**2,3,7**	**5**	**7**	**3**	**15**

Your company does daily unit pricing (UP) for all retail superannuation unit-linked product options. The job sits with a newly formed UP team. As the product actuary, you only review past unit pricing, and help solve pricing issues as they arise.

This morning, in a random review of unit prices published yesterday, you found that the unit price for the 'Aussie Share' option was wrong. The issue arose from a newly graduated staff member accidentally adding a $3 million amount into the 'Manual Asset Adjustment Field' to make asset movements reconcile.

You immediately notified the UP manager and re-calculated the correct unit price for the Aussie Share option - as shown below:

Aussie Share	**Incorrect UP**	**Corrected UP**
Net Asset Value	**$750,350,123**	**$747,350,123**
Number of units	**238,770,247**	**238,770,247**
Unit price	**3.1426**	**3.1300**

You also found out that the customer transactions were already processed last night using the incorrect unit price. The list of transactions is shown below:

Transaction	**Type**	**Amount**
Customer A	**Contribution**	**$10,000**
Customer B	**Withdrawal**	**$80,000**
Customer C	**Switch in**	**$15,000**
Customer D	**Switch out**	**$12,000**
Customer E	**Premium deduction**	**$1,500**

a) **Calculate the dollar amount each customer above gained or lost from this UP error, and propose and briefly justify a remedial solution for each of these customers.** **(4 marks)**

b) Having seen your remedial solutions, your UP manager proposes not to implement these adjustments. She thinks 'the amounts should average out'. Discuss with reasons whether you agree with her. (3 marks)

c) What regulatory requirements are there on the company to govern UP and UP incidents? What steps would you advise the business to take in order to prevent this from happening again? (3 marks)

d) Your company has some legacy business on historical UP. The UP manager wants your opinion on the arrangement. Draft a memo to your UP manager, explaining the potential problems with historical UP, and the transitional impacts on the company of such a movement from historical to forward UP. (5 marks)

QUESTION 4: SOLUTION **(15 marks)**

(a) (4 marks)

Transaction	Type	Cash impacts
A	Contribution	-40.09
B	Withdrawal	320.75
C	Switch in	-60.14
D	Switch out	48.11
E	Prm deduction	6.01

Example 1:
Customer A contributed $10,000 at a unit price of 3.1426.
Thus he purchased 10,000 / 3.1426 = 3182.0785 units.

However his 3182.0785 units are in fact worth only 3.1300 each.
He is left with an investment worth 3182.0785 x 3.1300 = $9,959.91

Customer A has lost $40.09.

Example 2:
Customer B has withdrawn units to the value of $80,000 at a unit price of 3.1426.
This represents the sale of 80,000 / 3.1426 = 25456.6283 units.

For the sale of this many units he should only have received
25456.6283 x 3.1300 = $79,679.25.

Customer B has benefited to the extent of $320.75.

The amounts for Customers C, D and E can be determined by a similar process.

For Customers A and C, who were negatively impacted by the UP error, the company needs to compensate them for this amount, ie. $40.09 for A and $60.14 for C into their funds. This can be achieved by reversing these transactions and reprocessing them at the correct unit price.

For Customer B, he / she made monetary gains from the error. As this money has already exited the fund, if Customer B has no investment left the company may not want to take any action, and a compensating amount should come from the shareholders' fund to balance the unit fund. If he / she still has remaining investments, the company may recoup this from the customer (subtracting units).

For Customers D and E, the customers made monetary gains from the error. As these transactions are internal transactions which means that funds are left with the company, the company may recoup these gains from the customers (subtracting units).

Marking guide:
½ mark for each customer impact correctly calculated;
½ mark for each customer for which a valid remedial solution is provided.

To a total of 5 marks.

Multiply this total by 0.8 to give a result out of 4 marks KU.

(b) (3 marks)

I would disagree with the UP manager.

- Equity issue: even though the amounts customers gain / lose from the error may roughly average out, the nature of the transactions are such that some customers gained, and some customers lost out. Not adjusting for the errors would mean not treating each customer fairly.
- Regulatory issue: under IFSA and ASIC, there are requirements for the company to act on unit pricing incidents. Not correcting these errors will be violating these requirements.
- Correcting unit prices without adjusting the transactions may lead to a bad relationship with the negatively impacted customers. This may result in loss of good will, and impact long term growth for the company.

Marking guide:
1 mark for disagreeing with the UP manager;
1 mark for equity issue (with proper reasoning);
1 mark for regulatory issue (with proper reasoning);
1 mark for potential loss of goodwill (with proper reasoning);
1 mark for each other valid point of discussion (with proper reasoning);

To a maximum of 3 marks total SJ.

(c) (3 marks)

Regulatory requirements:
- "Unit Pricing Guide to Good Practice - Joint ASIC and APRA Guide" released in November 2005.

Steps to avoid future errors:
- Separation of control between UP team and reconciliation team who do cashflows / asset reconciliation.
- Limit access of manual inputs to a number of senior staff.
- Having documentation process for any manual input into UP system.
- Implementation of review and checking for UP inputs.
- Implementation of reasonableness checks for UP movements against underlying asset index movements.

Marking guide:
½ mark for mentioning the ASIC and APRA guide;
½ mark for review / checking process of UP inputs;

To a total of 1 mark KU; plus

½ mark for each valid additional step proposed to limit UP error / risk;

To a maximum of 2 marks SJ.

(d) (5 marks)

Memo
To: UP manager
Cc: …
From: Product Actuary
Re: Historical UP problems and transitional impacts.

The potential problems with historical UP are:

+ Observing the underlying asset values, the customer will know the trend of future unit price movements (ie. whether unit prices will move up or down) before carrying out a transaction. This will present the customer with arbitrage opportunities, ie. buy before UP move up, and sell before UP move down.

+ Over the long run, this will cause the fund to under-perform compared to other funds with similar investment assets, ie. the unit holders who do not arbitrage will end up subsidising the ones who do. This will cause the fund to become unattractive from a performance view point.

+ In the case of an extreme market movement, this could result in a run on the fund, as alert customers seek to benefit before the impact of the market movement is reflected in the unit prices.

The transitional impacts of moving from historical to forward UP are:

+ There will be a time gap between the two approaches at the cut off date. This may cause confusion to the customers.

Let's assume that the cut-off date is 15^{th} Feb:

- if a customer submits a transaction on the 15^{th} Feb, they will get a unit price as at the end of 14^{th} Feb.
- if a customer submits a transaction on the 16^{th} Feb, they will get a unit price as at the end of 16^{th} Feb. This transaction will not be processed until 17^{th} Feb at the earliest.
- no transaction will be carried out with a unit price as at the end of 15^{th} Feb.

+ The system will need to be adjusted to handle the change in unit price input, ie. instead of processing a transaction on the spot, system will have to wait for the unit price input at the end of the day / next business day.

+ The change will need to be advised to customers in an appropriate fashion, with processes in place to respond to customer queries.

+ There will be a cost associated with the transition (system changes, staff training, customer notification). This will need to be balanced against possible economies of scale from the elimination of a legacy system.

Marking guide:
1 mark for each backward UP problem with valid reasoning;

To a maximum of 2 marks SJ; plus

1 mark for each transitional impact with valid reasoning;

To a maximum of 2 marks CJ; plus

1 mark CJ for proper formatting and language for the memo.

QUESTION 5 **(17 marks)**

Analysis

Component	Aim	KU	SJ	CJ	Total
Part a)	4,6		3		3
Part b)	6,11		3		3
Part c)	8,9		4		4
Part d)	1,3			3	3
Part e)	1,12			4	4
Total	**1,3,4,6,8,9,11,12**	**0**	**10**	**7**	**17**

Your company offers "Mortgage Protection" in conjunction with home loans provided by a banking partner. "Mortgage Protection" is a decreasing Sum Insured, stepped premium, yearly renewable term life insurance with an optional trauma rider. Sales for "Mortgage Protection" have been slow lately.

The product manager wants to re-price the existing "Mortgage Protection", and launch an extra version, "Protection Plus", with the aim of boosting sales. Among other things, she wants "Protection Plus" to have the following characteristics:

- **Single premium 10-year level term cover so that the premium can be incorporated into the loan amount.**
- **Single premium trauma rider with matching duration of cover, with definitions of trauma conditions regularly improved to reflect market developments (same as existing practice for "Mortgage Protection").**
- **No refund / surrender value to keep product administration simple.**

a) **Describe how "Protection Plus" differs from "Mortgage Protection", in terms of the investment and insurance risks the product poses to the company. (3 marks)**

b) **Describe how you would arrive at an appropriate interest rate assumption for "Protection Plus", stating any differences from the earnings rate assumption you would use for "Mortgage Protection". (3 marks)**

c) **Describe how you would arrive at mortality and morbidity assumptions for "Protection Plus", stating any differences from the mortality and morbidity assumptions for "Mortgage Protection". (4 marks)**

d) **Describe the issues the company may have with not offering a refund / surrender value on "Protection Plus". (3 marks)**

e) **Discuss the advantages and disadvantages of each product design for mortgage purchasers in the Australian market. (4 marks)**

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

Note to markers: There was an unintentional ambiguity in the wording of this question. It can legitimately be interpreted to say that the trauma rider is optional for the existing "Mortgage Protection" product, but mandatory for the proposed "Protection Plus" product. This was not intended (it was intended that the trauma rider should be optional under both products), but candidates who do identify this difference and the consequent impact on insurance risk should be awarded appropriate marks in sections (a), (c), (d) and (e) below.

(a) (3 marks)

<u>Investment risk:</u>
Single premium 10-year cover is effectively a long term insurance bond, which is more sensitive to interest rate movements. The company will solely wear this risk.

This is a significant risk compared to the decreasing SI stepped premium design, where a significant portion of the premium is spent during the earlier period and is therefore less sensitive to interest rates.

<u>Insurance risk:</u>
Single premium 10 year cover locks in the premium at inception, effectively guaranteeing the premium for 10 years. If there is a movement in mortality / morbidity experience, the company wears all the gain / loss. Also, the regular updates of trauma definitions over 10 years will be hard to price up-front.

On the contrary, the decreasing SI stepped premium insurance risk is lower than that for the single premium insurance:

- If the claims experience is worse than expected the company can increase the premiums;
- The insurance risk does not need to be predicted as far ahead as the premiums are not guaranteed;
- For the trauma rider, the premiums can be adjusted along with any future improvements to benefits;
- The extent of the risk for the decreasing SI product decreases with time, while for the single premium product it increases slightly with time (as the reserve reduces).

Marking guide:
1 mark for explaining the impacts of long term guaranteed nature of 10-year single premium cover on risks;
1 mark for explaining the impacts of short term up-front non-guaranteed nature of decreasing SI stepped premium cover on risks;
1 mark for saying that Mortgage Protection is safer than Protection Plus;
1 mark for other valid point;

To a maximum of 3 marks SJ.

(b) (3 marks)

The interest rate for "Protection Plus" should be biased towards assets with appropriate duration compared to that of the liabilities, eg. a mix of cash (for liquidity), 2-year, 5-year, and 10-year bond yields. There may be other investment instruments which could be taken into consideration.

On the contrary, Mortgage Protection earning rate should be the current or long term expected cash rate at the time of pricing (cash rate allowing for expectation about future movements).

Marking guide:
1 mark for duration matching;
1 mark for suggestion of bonds / other instruments with appropriate duration for Protection Plus;
1 mark for suggestion of short term / cash rates for Mortgage Protection;
1 mark can be given for other suitably justified interest rates;

To a maximum of 3 marks SJ.

(c) (4 marks)

"Protection Plus" pricing locks in the mortality assumption for 10 years. Start off with the current mortality basis used for the existing "Mortgage Protection" product, or the latest mortality tables allowing for company experience. However, adjustments may need to be done to allow for a lower level of anti-selection (up-front payment of premium will reduce the incentive to select against the company) and possible mortality changes (improvement) over 10 years.

"Protection Plus" pricing locks in the trauma morbidity assumption for 10 years. Start off with the current morbidity basis used for the existing "Mortgage Protection" product. Adjustment, or conservative margin, will need to be built in to allow for changes in morbidity experience in the future (likely to get worse with the advance in diagnosis techniques). Further adjustment will be needed to allow for future changes in trauma claim definitions (likely to increase claim costs as benefits tend to be more relaxed with each review).

Marking guide:
½ mark for suitable starting mortality experience ("Mortgage Protection or adjusted table);
1 mark for possible reduced anti-selection;
1 mark for allowance for future mortality improvements;
½ mark for suitable starting morbidity experience ("Mortgage Protection" basis);
1 mark for likely deterioration in morbidity experience;
1 mark for impact of likely benefit improvements;
1 mark for any other valid point;

To a maximum of 4 marks SJ.

(d) (3 marks)

Issues:

- Will be harder to sell as even though total premium may be lower, customers will not feel secure locking in a large premium amount upfront.
- Reputation risk, as customer may cancel a few months after paying the single premium and get zero value out of the product.
- The product may contradict IFSA standards for CCI products, and APRA's Minimum Surrender Value Standard 4.02.
- The product will be lapse supportive (ie. more profitable if the customers lapse early) which presents the company with a conflict of interest.

Marking guide:
1 mark for each issue as above identified and explained;
1 mark for any other valid issue identified and explained;

To a maximum of 3 marks CJ.

(e) (4 marks)

Mortgage Protection:

- Advantages:
  - Simple product – easy for customers to understand.
  - Reducing SI will closely match the loan run down of Principal & Interest loans.
  - Cost of insurance reduces with reduced needs.
  - Premiums may be cheaper as the company does not need to be as conservative in setting non-guaranteed rates.
- Disadvantages:
  - Lower insurance protection leads over time to a less relevant product.
  - Is not suitable for loans with "top-up" or prolonged paybacks.

Protection Plus:

- Advantages:
  - Fully funded into the loan, giving customers a seamless experience.
  - Level cover which will be suitable for interest repayment only loan, or loans with redraw facility up to pre-determined limits.
  - No unexpected costs, as all are paid up-front.
- Disadvantages:
  - High up-front premium.
  - No lapse value which is less customer-friendly.
  - Fixed duration cover, which will not suit loans of different duration.
  - Company may be conservative in setting premiums due to the guaranteed cover provided.

Marking guide:

1 mark for each product advantage discussed (½ mark if the advantage is only identified);

½ mark for each product disadvantage which is the reciprocal of an advantage identified/discussed for the other product;

1 mark for each other disadvantage discussed (½ mark if the disadvantage is only identified);

To a maximum of 4 marks CJ.

QUESTION 6 **(17 marks)**

Analysis

Component	**Aim**	**KU**	**SJ**	**CJ**	**Total**
Part a)	1,3		3		3
Part b)	3,4,6,7			7	7
Part c)	3,4,6,7			7	7
Total	**1,3,4,6,7**	**0**	**3**	**14**	**17**

There have been few new products introduced to the Australian retirement product market in recent years. Some offices provide lifetime annuities, but the most common product offering is an "account-based" pension.

Your Head of Strategy has recently arrived in Australia and believes the future of the industry is going to be retirement services, and plans to 'lead the charge' in product innovation in this field.

a) **He wonders why Lifetime Annuities, a seemingly perfect answer for retirement, have not been more successful in the Australian market. Discuss the possible reasons for this.** **(3 marks)**

b) **Staying awake late at night surfing the internet for inspiration, he came across the product "Lifetime for Nothing" – "*a product that allows retirees to unlock part of the equity in their own house, to fund a lifetime guaranteed income. The retirees still retain ownership over their property. The insurer only gets their money from the estate after the retirees pass away, with any surplus going to the estate*". Your Head of Strategy thinks this is a wonderful idea. Discuss the risks and risk mitigation options the company needs to address in order to develop this product.** **(7 marks)**

c) **Another late night internet session gave your Head of Strategy the product "Forever Rising" – "*a product that gives retirees a lifetime income that is expected to rise over time in line with the selected asset basket index. The retiree can even lock in the income, guaranteeing that it will never go down below the current level*". Again he thinks it is a wonderful concept. Discuss the risks and risk mitigation options the company needs to address in order to develop this product.** **(7 marks)**

QUESTION 6: SOLUTION **(17 marks)**

(a) (3 marks)

Reasons:
- Perceived as expensive / lacking value for money, due to the public's lack of appreciation for longevity and investment risks.
- Tie up a large sum of money.
- Hard to surrender (if any surrender value available) and unattractive surrender value.
- Nothing left over upon death, which is unpopular in the Australian market (i.e. risk of early death is borne by the policyholder).
- New regulation makes "account-based" pension a lot more attractive in terms of withdrawal freedom.
- Loss of control of investment choice.

Marking guide:

1 mark for each reason as above with proper discussion;
1 mark for any other valid reason with proper discussion;

To a maximum of 3 marks SJ.

(b) (7 marks)

Risks:
- Longevity risk: risk of customer living longer than expected and the value of the accumulated payments is higher than expected.
- Negative equity risk: if the product does not have a "stop-loss" caveat in place, the gap between accumulated payments and property value can be significant.
- Interest risk: during the life of the policy, interest rate movements may cause the accumulated value of payments to be higher than expected.
- Property value risk: property value fluctuation may cause future values of the property to be lower than expected.
- Legal risk: the ownership of the property, and inheritance rights may be disputed which can delay estate settlement.
- Reputation risk: if the product does have a "stop-loss" caveat, the company may suffer "60 minutes" reputation damage of forcing the retirees to sell their house to cover the accumulated payment cost.
- Mis-selling risk: the advisers can present the customers with over-optimistic scenarios which predict high surplus levels to the estate.

Mitigation options:
- Product design: the product can be structured to mitigate the longevity risk by "locking in" the retirement income stream at inception by purchasing an immediate annuity.
- Product design: implement stop-loss caveat to limit the exposure to negative equity risk.

- Product design: limit up-front expected cost of annuity stream to a percentage of the market value of the property.
- Pricing to include contingency margin.
- Hedging strategy: interest, property value risk, and negative equity risks can potentially be hedged, or securitised.
- Adviser and customer's education: to limit the reputation and mis-selling risks.

Marking guide:
1 mark for each risk identified and explained as above;
1 mark for any other valid risk identified and explained;

To maximum of 4 marks; plus

1 mark for each mitigation option as above identified and explained;
1 mark for each other valid mitigation option identified and explained;

To a maximum of 4 marks;

To a maximum of 7 marks CJ.

Note to Markers: The risks listed above arise out of the nature of the product under consideration. There are additional risks, such as legislative change, system issues etc, that apply to just about all products. As there are several risks and risk mitigation strategies that are relevant (and necessary) to the particular product under consideration, and thus multiple ways to earn the available marks, marks should not be awarded for suggested generally applicable risks (and risk minimisation strategies).

(c) (7 marks)

Risks:

- Longevity risk: the risk of customers living longer and the cost of annuity payments being higher than expected.
- Asset and liability matching risk: the annuity premium will need to be invested in assets linked to the index chosen by the customers, and / or options to back the guarantee of income not falling below current levels. These assets or options may not be available (e.g. long term required to match liability term) / prohibitively expensive.
- 3rd party default risk: if the market drops, the option may default leaving the company exposed.
- Pricing risk: hard to measure cost of guarantee, or the cost will be so great that it is unattractive.
- Mis-selling risk: the advisers may present the product such that the income stream is perceived as rising steadily, which will not be the case in fluctuating market conditions.

Mitigation options:

- Product pricing with sufficient contingency margin to allow for these risks.
- Additional capital to allow for mis-pricing of the risks.
- Hedging strategy to address the ALM risk, or securitisation of the portfolio.
- Education of customers and advisers to address mis-selling risk.

Marking guide:
1 mark for each risk identified and explained as above;
1 mark for any other valid risk identified and explained;

To maximum of 4 marks; plus

1 mark for each mitigation option as above identified and explained;
1 mark for each other valid mitigation option identified and explained;

To a maximum of 4 marks;

To a maximum of 7 marks CJ.

Note to Markers: The risks listed above arise out of the nature of the product under consideration. There are additional risks, such as legislative change, system issues etc, that apply to just about all products. As there are several risks and risk mitigation strategies that are relevant (and necessary) to the particular product under consideration, and thus multiple ways to earn the available marks, marks should not be awarded for suggested generally applicable risks (and risk minimisation strategies).

