INSTITUTE OF ACTUARIES OF AUSTRALIA

LIFE INSURANCE **2003 EXAMINATIONS**
EXAM SOLUTIONS **PAPER ONE**

MARKING GUIDE

Level of Difficulty

PAPER ONE

Question	Syllabus Aims	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
Q 1a	11,12		2			**2**
Q 1b	11,12		4			**4**
Q 1c	11,12		4	5		**9**
Q 2a	1		5			**5**
Q 2b	7			5		**5**
Q 2c	9			8	2	**10**
Q 3a	4,6,9			6		**6**
Q 3b	4,6,9				4	**4**
Q 3c	4,6,9				5	**5**
Q 4a	13,14		4			**4**
Q 4b	13,14		4			**4**
Q 4c	13,14			8		**8**
Q 5	7,8,11			5	10	**15**
Q6	10, 17			4	15	**19**
TOTAL			**23**	**41**	**36**	**100**

QUESTION 1 **(15 marks)**

You are the valuation actuary of an Australian life insurance company. The Board of Directors of this company has just undergone substantial reconstruction with four new directors being appointed. Three of these new directors already have a financial services background. However, the remaining new director only has extensive experience of the mining and manufacturing industries. After his first Board education session he has asked a number of questions which the Appointed Actuary has passed onto you to prepare answers.

(a) What is the basic concept of a liability? **(2 marks)**

(b) I understand that you have to calculate more than one type of liability. What types of liabilities do you have to calculate and state their regulatory or statutory purpose. **(4 marks)**

(c) I have heard that the calculation of the policy liability takes a considerable amount of time and resources. Explain why this is the case by briefly describing the steps involved to calculate the policy liability. Describing the calculations themselves in detail is not required. **(9 marks)**

QUESTION 1: SOLUTION **(15 marks)**

(a)

A liability represents the future outflow of cashflows less inflows if applicable over a period of time. Depending upon the period of time it may be appropriate to take the present value of these outflows. (2 marks)

(b)

The different types of liabilities include:

- Policy liability used for reporting profit.
- Policy liability used for the calculation of tax liabilities.
- Solvency liability used for reporting of solvency requirement.
- Capital adequacy liability used for the reporting of capital adequacy requirement.
- Best Estimate Liability used as an intermediate step in the calculation of Policy Liability.

(1 mark for each point – maximum of 4 marks.)

(c)

- Collect & verify data. (2 marks)
- Review experience and revise assumptions. (2 marks)
- Review models & methodology (legislative, pricing, product, and reinsurance changes). (2 marks)

- Run Valuation. (1 mark)
- Check & analyse results (analysis of profit & integrity checks). (2 marks)
- Documentation of results. (1 bonus mark)

To gain full marks as shown a brief description of each should be given.

QUESTION 2 **(20 marks)**

You are the Appointed Actuary of a small Australian life insurance company, which is a subsidiary of a large funds management business. To date, the life insurer has restricted its product range to investment linked business.

The downturn in equity markets has resulted in profits tumbling and a new CEO of the funds management business being appointed. The new CEO has urged staff to think laterally to generate new ideas to grow the business.

The recently appointed Strategic Planning Manager has observed that income protection is a rapidly growing market, and he is confident that the existing relationships with financial planners will generate enough volume of sales to achieve critical mass within a short timeframe. He has approached you for feedback on his proposal to enter this market, and input into his Board briefing paper.

(a) Describe the product features of an income protection product. (5 marks)

(b) Describe the most significant risks that may impact the product profitability of an income protection product, and explain why each is a risk. (5 marks)

(c) List and briefly describe the practical steps required to implement the proposed income protection product. (10 marks)

QUESTION 2: SOLUTION **(20 marks)**

(a)

Ref - 2.77 of textbook, plus some more detailed understanding of the product that is expected of a specialist.

The product features include:
- Provide regular (usually monthly) benefits on disability during the period of disablement.
- Disablement is a defined term – variety of definitions exist in the market.
- After a defined Waiting Period (eg 14 days/30 days/90 days).
- Up to a defined maximum Benefit Period (eg 2 yrs / 5 yrs) or maximum age (eg 65).
- Claims escalation is often an option (if receiving a benefit, the benefit is indexed to CPI).
- Premium is usually ‘stepped’ (generally increasing with age), and payable on a regular basis (at least annually).
- Sum Insured (Benefit Amount) is usually automatically indexed to inflation (CPI). subject to the policyholder having right to decline an offer to increase.
- The Benefit Amount can be ‘Agreed value’, or capped at an ‘Indemnity’ amount, based on a percentage of earnings immediately prior to the disablement occurring.

- Commission payable to an adviser is usually of the order of 100% of first year premium plus 5-10% of renewal premium received.
- Waiver of premium benefit whilst disabled.
- Partial disability benefit.
- Nursing benefit.
- Rehabilitation benefit.
- Minimum payments upon specified events.

(½ mark per valid point, extra half mark for good attempts at one or more examples of disablement definitions in use. Maximum 5 marks.)

(b)

The key risks include:

- Morbidity – claims incidence worse than expected. Claims cost higher than expected. Consumerism is making it harder for insurers in marginal cases of disablement. Lack of expertise in underwriting and claims management is a key risk.
- Morbidity - Claims terminations lower than expected (i.e. average claims duration longer than expected). Claims cost higher than expected. Consumerism is making it harder for insurers in marginal cases of disablement. Lack of expertise in underwriting and claims management is a key risk.
- Discontinuances higher than expected. Large initial expenses due to commission and underwriting. These expenses to be recouped over several years.
- Acquisition Expenses – higher than allowed for in product pricing. Need to carry out underwriting functions. Marketing material, etc, implies significant fixed costs. Distribution – compliance and training costs.
- Maintenance and claims management expenses – higher than allowed for in product pricing. Complex product. Claims management is critical.
- Investment risk on claims reserves unless matched.

(1 mark per point, maximum 5 marks)

(c)

The key tasks to be undertaken include the following:

- Product definition including competitor product research/analysis.
- Product pricing and profit testing.
- Establish an Underwriting and a Claims Management function.
- Determine underwriting guidelines (medical and financial), including occupation ratings, etc.
- Reinsurance – design/develop requirements; negotiations; etc.
- Administration, accounting and actuarial valuation systems.
- Management reporting / product control systems.
- Sales process – premium quotations, CIB / Product Disclosure Statement (PDS), competency training, etc.
- Product launch and promotion.
- Agency/commission agreements.

- Capital requirements funded.
- New statutory fund is required as this is not investment linked.

(1 mark per point, maximum 10 marks – half mark maximum for identifying the point, half a mark for brief description.)

INSTITUTE OF ACTUARIES OF AUSTRALIA

LIFE INSURANCE **2003 EXAMINATIONS**
EXAM SOLUTIONS **PAPER ONE**

QUESTION 3 **(15 marks)**

You are the pricing actuary for a medium sized life office that has decided to enter into the group life market for death (GL) and total and permanent disability (GTPD).

When pricing large schemes, it is common to take into account the scheme's prior claims experience. As part of the pricing basis it is necessary to develop guidelines for the experience-rating factor (ERF) to be applied to the base premium rates when determining the premium to be charged for a scheme that is transferring its existing insurance arrangements from another insurer.

(a) Describe the information you will require regarding the scheme's past performance and how it is taken into account in determining the premium rates. (6 marks)

(b) Outline the checks and adjustments you would apply to the components of the past performance. (4 marks)

(c) What additional information would you require and what additional considerations are necessary if you were pricing group salary continuance (GSC) rather than GL and GTPD? (5 marks)

QUESTION 3: SOLUTION **(15 marks)**

(a)

In assessing the past performance of a scheme you should consider:

1. Membership History

The number of members of the scheme both currently and for each historical year of membership to be considered. (1 mark)

2. Claims History

The number of claims and the amount of claims for each of the historical years to be considered, and any IBNR or RBNA. (1 mark)

The information is used as follows:

For the period of past experience to be considered the total of the dollar value of the claims paid plus any IBNR and RBNA claims is divided by the total man-years of experience (this is approximated by adding up the annual membership at each policy anniversary) to determine an historical claim amount per member.

This is then multiplied by the current membership to determine an expected total claims per annum. (1 mark)

This is then divided by the base premium determined by taking the current membership and benefit levels but before any expense or profit loadings (i.e. the base risk premium) to determine an expected loss ratio (expected claims / expected premium). (1 mark)

In determining how reliable this expected loss ratio is an ERF needs to be determined such that the premium to be charged is calculated as ERF * base premium rate. So that if the experience is worse than expected the ERF is greater than 1 and if the experience is better than expected the ERF is less than one. (1 mark)

In determining the ERF a level of credibility needs to be given to the expected loss ratio that will depend on the volume and volatility of experience thus the more man-years of exposure the more reliable the past experience and the greater the number of claims the more stable the year to year experience is likely to be. (1 mark)

An alternative response was also given credit by the examiners. In it the 6 marks were for the relevant discussion around the 6 points:

1. Membership/Exposure
2. Claims
3. Actual experience of scheme
4. Expected experience of scheme / Actual on Expected
5. Credibility
6. Linking this back to the premium rate to be charged

(b)

Consideration should be given to the factors as follows:

1. Membership History

If there has been a significant change in the volume of members – significant increase or decrease – or the turnover of membership has been high then this would suggest that the past performance may have little correlation to future performance and the ERF may not be relevant. A 25% change in membership is considered to warrant a recalculation of premium (termination of any premium rate guarantee) and is probably an appropriate level to set to discount the value of the calculated ERF. (1 mark)

2. Claims History

If there appears to be unusually large or small claims these should be investigated. The scheme may have a few members with large sums insured and these may cloud the claims experience. Also a large proportion of denied and/or pending claims (TPD) would suggest care needs to be taken in evaluating the past claims experience. Where there is sufficient detail available then a run off triangle for claims delays should be done and an adjustment for IBNR made. (1 mark)

3. Benefit Design

If there has been any change in the benefit design that has resulted in the cover per member to have increased or decreased the past claims should be adjusted to reflect what amount they would be under the current benefit design to ensure that the comparison from year to year is like with like.

If there are a few members with much larger sums insured than the majority of members then this will add some volatility to the claims experience. It may be more appropriate to remove these from the experience and either give them separate consideration or add a margin into the pricing to take account of this additional volatility.

Are the definitions of TPD consistent? Does the TPD benefit behave the same over the last years of membership (both taper or level)? (1 mark)

4. Premium Paid

If the premium history is used to look at historical loss ratios and these are used to determine a factor to apply to the base premium then these past premiums should be recalculated on a basis consistent with the current pricing basis or they will not provide a like with like calculation. (e.g. If the past premiums have different loadings or occupational assumptions then they will overstate or understate the amount that would have been received on the current pricing basis and the loss ratios determined using them will not be indicative of what the past experience would have been under the current pricing basis.) (1 mark)

In part a) or b) extra marks were given for some additional points:

¼ mark	changes in underwriting and AAL's – provided it's linked to claims experience or premium rates in some way in the answer
¼ mark	adjust past experience for reinsurance
¼ mark	take account of legal disputes
¼ mark	data integrity checks
½ mark	adjust experience for any past catastrophic event

(c)

The main differences with GSC as opposed to GL & TPD are:

- In addition to claims paid, RBNA and IBNR it is necessary to get sufficient information to calculate a reserve for all claims in course of payment. So details of each open claim will be needed or the claim reserve in respect of each claim.

- The reserve for each open claim should be considered. It is best if it is calculated on the current pricing basis as this may differ from the past experience basis. Where there are only a few claims or very large claims these should be investigated to see whether the calculated reserve is reasonable.

- Benefit Design: Ensure that the waiting periods and benefit periods haven't changed and that the offset conditions are consistent (sick leave, workers compensation etc). Do the old and new both have the same claims escalation? Eligibility and calculation of Partial disability benefits may also differ and these should be compared.

- Definition of Disability: Are the definitions consistent or is one more onerous?

- Termination Rates: If there is sufficient information available then an analysis of the termination rates of claims should be done to ensure that they are not significantly different from the pricing basis.

(1 mark each with maximum of 5 marks)

Extra marks were also awarded for some common additional points:

- economic environment is thought to influence GSC claims experience (1/4 mark)
- GSC has greater administration expenses than GL or GTPD (1/4 mark)
- for mentioning policy options provided they were GSC specific types of options (1/2 mark)
- for saying something about the industry claims experience data available for GSC (1/4 mark)

QUESTION 4 **(16 marks)**

You are a consulting actuary advising a medium sized life insurance company in Asia transacting non-participating traditional (whole of life and endowment assurance) business. The current profit reporting requirements are based on a solvency liability. There are two new directors on the Board. One has experience with another life insurance company where periodic Appraisal Values were calculated. The other has been involved in a life insurance company where the Margin on Services valuation method has been used to report realistic profit.

The Board wishes to introduce a more realistic method of assessing the financial performance of the company and is aware that these two different approaches (i.e. Appraisal Value and Margin on Services) exist. The Board has requested that you prepare for it a report covering the following:

(a) A brief description of the Appraisal Value and Margin on Services methods. (4 marks)

(b) A summary of the advantages and disadvantages of each method. (4 marks)

(c) A discussion of the four most significant potential causes of volatility in reported profit using each method. (8 marks)

QUESTION 4: SOLUTION **(16 marks)**

(a) <u>Appraisal Values</u> (2 marks)

A measure, at a point in time, of the value of a company, comprising

- Adjusted net worth
- Value of in-force business
- Value of future new business

The change in appraisal value over a period reflects the financial performance of the company. Future profits are calculated after tax and discounted at a risk discount rate.

<u>Margin on Services</u> (2 marks)

Explicit margins are built into the valuation basis, with the expectation that they will be released as experience follows the underlying assumptions (best estimate).

The profit over a period is the planned profit release, plus variation in the experience relative to assumptions which generates experience profit/loss, plus interest on net assets.

(b)

Comparison (½ mark per valid point)

Advantages of Appraisal Values (maximum 1 mark)
- Relate to market value of the office.
- Periodic value readily understood.
- Allows future effects of current actions to be reflected immediately in assessed performance.
- Easier to recalculate on different assumptions.
- Sensitivity analysis allows potential impacts of management action to be understood.

Disadvantages of Appraisal Values (maximum 1 mark)
- Very sensitive to assumptions (sensitivity analysis required to identify the effect of change).
- Capitalises future profits.
- Movement in appraisal value is not easily related (conceptually) to experience
- Value of new business is highly dependent upon the new business multiple, and whilst a consistent multiple can be used, it is becoming more common to provide the value of 1 years new business to assess financial performance.
- Choice of discount rate can be difficult.

Advantages of Margin on Services (maximum 1 mark)
- Profit emerges as the relevant service is performed.
- Future profits are not capitalised.
- Profit is easily understood.
- Profit not impacted by change in assumptions (except for loss recognition).

Disadvantages of Margin on Services (maximum 1 mark)
- Periodic value of the company is not clear.
- Future effects of current actions not recognised.
- Additional work when assumptions change to re-equate profit margins.
- There is no allowance/impact for the cost of capital.
- Analysis of profit difficult if accumulation method is used.

(c)

The student should identify four sources of significant volatility for each of AV and MoS approaches (one mark per valid point). Marks are also awarded for recognising that AV impacts are immediately capitalised (making assumption changes key), whereas MoS assumption changes are smoothed (except for loss recognition/reversal) thus making experience items key.

Appraisal Value
In general these are assumption changes because of the immediate capitalisation effect. (1 mark)
- Decrement rates – discontinuance, mortality.

- Expense rates (maintenance/acquisition/investment).
- Volume of new business sales.
- Investment earnings / risk discount assumption.

Margin on Services
In general these are experience items, except where loss recognition/reversal becomes an issue. (1 mark)

- Decrements – discontinuance, mortality.
- Maintenance expenses (note acquisition not quite as important as deferral occurs).
- Investment (asset/liability mismatch).

If loss recognition occurs, profit volatility can arise from changes in key assumptions, including:

- Discontinuance.
- Mortality.
- Maintenance or investment expenses.
- Asset mix.

QUESTION 5 (15 marks)

You are the Appointed Actuary of an old established proprietary Australian life insurance company, which has just acquired another Australian life insurance company. The Board of Directors has requested a report on the considerations that need to be made in determining whether or not the two companies should be merged.

Outline the investigations that would need to be made in order to recommend a basis for merging the companies. Explain how each investigation will help you make your recommendations.

QUESTION 5: SOLUTION (15 marks)

In order for the basis of merging to be approved, the main issues to be considered are the security of policyholder benefits and meeting policyholder expectations. Of these two issues the latter is most likely to require detailed investigation, as the rights of both sets of participating policyholders need to be clearly identified. For non-participating policyholders equity before and after the merger is not as important provided there is security of benefit payments. (2 marks)

The relationship between each company's participating policyholders to the other in the merged entity should be quantified. The usual means of quantification is via the bonus rates, with a relationship set between the two groups of policyholders eg for one group of policyholders their bonus rate will be a set percentage of the other group of policyholders. (2 marks)

In order to determine this relationship the following investigations should be made:

- The statutory fund structure of both companies, along with the business written in each fund, which business is participating and non-participating.
- The premium rates of both companies, along with pricing notes.
- Assets & liabilities of each company & respective valuation bases.
- The bonus distribution policy of both companies including methods of distribution.
- The surrender value bases of each company.
- Policy holder reasonable expectations based on promotional material, correspondence, etc
- The existing expense structure of each company and the likely expense structure of the merged entity.
- Historical persistency rates of both companies and the likely persistency rates to apply immediately after the merger including shock lapses in the first year.

(½ mark per point – maximum 4 marks)

From the above investigations the bonus earning capacity of each company's participating portfolio can be assessed using projected cash flow techniques. This ought to give a reasonable basis for determining the bonus relativities between each portfolio of participating business. (2 marks)

For the non-participating business, projected solvency and capital adequacy positions should be performed using the above information to show that there has been no decrease in the level of security being provided to policyholders. (2 marks)

Other investigations include:

- Tax impact
- Expense synergies
- Ability to rationalise systems
- Any legal/contractual issues (eg. Around debt security, agency agreements, etc)

(1 mark per valid point – maximum 3 marks)

QUESTION 6 **(19 marks)**

You are the Appointed Actuary of Good Life Limited, a small Australian life insurance company established in 1994. Good Life has one statutory fund, operates only in Australia and is dominated by participating traditional business. The company has an entrepreneurial Board, and has been very successful in expanding organically and through acquisition of other companies' closed books of traditional business. The business model, which is one of low costs and equity based investment policy, has historically returned healthy profits to the shareholders.

The acquired business generally has a history of stable bonus rates being declared – and has been supported by policyholder retained earnings built up over decades.

Since the last balance date, there has been a significant fall in the equity markets – the domestic share market is down 20% from its peak. Bond yields have hit all time lows.

The current asset mix of the fund is as follows:

Domestic equities	**50%**
Property	**20%**
Fixed interest	**20%**
Cash	**10%**

The Managing Director remains optimistic, and believes that the company should:

- **take advantage of the fall in equity markets to promote the guaranteed nature of these products to financial advisers;**
- **invest the funds currently held in fixed interest and cash in equities – arguing that bond yields are so low that the fixed interest sector represents a very risky investment; and**
- **reduce surrender values in order to allow this to occur – to lock people in and stop them from surrendering their policies.**

(a) Outline the responsibilities of the Appointed Actuary under the Life Insurance Act in relation to this issue. **(2 marks)**

(b) Outline the responsibilities of the Directors under the Life Insurance Act in relation to this issue. **(2 marks)**

(c) What investigations would you perform before providing advice on the Managing Director's proposal, and what other issues do you believe should be considered in making the decision? **(12 marks)**

(d) Would it be appropriate for you to use any discretions in calculating the solvency and capital adequacy requirements after the proposal is implemented? State your reasons. **(3 marks)**

QUESTION 6: SOLUTION **(19 marks)**

(a)

The responsibilities of the Appointed Actuary include:

- reporting on policy liabilities and providing an assessment of compliance with solvency and capital adequacy standards during the year at the request of the company (S113 requires the company to have its appointed actuary perform these tasks).
- drawing attention to the company any matter that the Actuary thinks requires action to be taken by the company or its Directors to avoid prejudice to the interests of the owners of policies issued by the company (section 98). This might include such matters as breaches of the minimum surrender value standard.

(2 marks – one per point)

[note – the above is a bit narrow – the key is that based on the Act, the actuary can advise, but does not have a power of veto over investment policy, surrender values, etc, unless one of the above points applies. Judgement is required.]

(b)

The responsibilities of the Directors include:

- giving priority to the interests of policy owners – this may include policyholder reasonable expectations (surrender values, bonus rates, solvency position / risk).
- compliance with minimum surrender value, solvency and capital adequacy standards.

(2 marks – one per point)

(c)

Investigations include:

Surrender Values

- Current and proposed surrender value scales – comparison to criteria for a good scale (equity, solvency, stability, ease of calculation, consistency and marketability). (1 mark)
- Comparison to Life Insurance Act Minimum Surrender Value basis or rates guaranteed in promotional material, contract terms etc. (1 mark)
- Review current and proposed surrender values compared to asset shares - is it reasonable to reduce surrender values given the investment performance (eg removal of terminal bonuses). (1 mark)

Other

- Current and projected capital adequacy and solvency positions after the new asset mix is adopted (eg change in Resilience Reserves), and new business volumes are varied. (1 mark)
- Target surplus – revise amount required for new asset mix. (1 mark)

- Review any scheme documentation relating to acquired business - minimum bonus rates etc. (1 mark)
- Review projected cash flow and scenario testing allowing for different investment returns. (1 mark)
- Review access to additional capital. (1 mark)
- Review impact of changes on forecast shareholder profit. (1 mark)
- Consider any tax impact of change in asset mix. (1 mark)
- Review promotional material and other client correspondence (eg statements) over (say) the last five years to identify material that may have given rise to particular policyholder reasonable expectations regarding bonus rates or surrender values. (1 mark)
- Investigations into past bonus rates and relating it to policyholder expectations (1 mark)
- Investigations into market position of the proposed surrender scale (1/2 mark)
- Investigate the impact of transaction costs that may be incurred in changing asset mix (1 mark)
- Review administration issues in changing the surrender values (1 mark)
- Consider any reinsurance implications of the change (1 mark)

(1 mark per additional valid investigation that may not be covered above – maximum of 9 marks.)

Other issues include:

- Equity – using capital from existing policyholders (by reducing surrender values, reducing bonus rates to support solvency position, etc) to support new business may be inequitable, particularly if the resultant bonus rates and surrender values fail to meet policyowner reasonable expectations. (1 mark)
- Potential for negative perceptions from distribution network – this may impact upon new business volumes and retention. (1 mark)
- Potential for negative publicity, brand damage, policyholder complaints that their risk has increased but their return has reduced etc. (1 mark)

Note – some students may put investigations in with issues in answering this part of the question – this is acceptable – the marks should be awarded for recognising the point rather than which list it appears on.

(d)

Note – this company 'is dominated by participating conventional business'. Discretions should therefore be limited to reducing bonus rates. Increases in premium rates (on existing business), changes to expense charges, etc, are not relevant. Referral to the possibility of using these discretions suggests that the student has not demonstrated the degree of judgement required by this question.

Discretions that may be used include:

i) Reduction of future bonuses and/or elimination of Terminal Bonuses in the calculation of the solvency liability and/or capital adequacy liability, and in the resilience reserve calculations.

Issue of reducing assumed bonus rates further (e.g. to support new business reserve) requires consideration of policyholder reasonable expectations and understanding of the Board's attitude towards reduction of bonus rates to provide capital for the new business, etc.

Reasonable to allow for reduced bonuses (incl. Terminal bonus) to allow for asset shocks.

ii) Reduction in Termination Value is appropriate in the resilience shock scenario, but only to the extent that the current Termination Value exceeds Life Insurance Act minimum requirements.

Marking guide: ½ mark for identifying each of these as the relevant discretion to consider. Up to 1 mark for the reasons for or against each (total 3 marks).

END OF PAPER ONE SOLUTIONS