INSTITUTE OF ACTUARIES OF AUSTRALIA

LIFE INSURANCE **2001 EXAMINATIONS**
SOLUTIONS **PAPER 2**

QUESTION 1 **9 marks**

(a) Actual returns calculated as:

2 x (I + C - T) / (A + B – (I + C- T))

gives actual return of 5.8%

1 Mark for formula, 1 mark for result

(b) If the company was invested in the index over the year, the expected return would have been 50% * 5% + 50% * (2652.4 / 2456.3 – 1) = 6.5%

This return must be compared with the gross of tax return on the portfolio

The gross return on the portfolio is 6.9%

The actual gross return from dividends and interest is 6.4%.

This compares to an expected return of 50% * 5% + 50% * (2652.4 / 2456.3 – 1492.1 / 1428.5) = 4.3%

Overall, the portfolio has outperformed the market.

This is particularly the case in the dividend and interest return.

This may have arisen due to the company being invested in shares significantly different from the index, however it may also point to an error.

1 mark per point or calculation, maximum 7 marks

QUESTION 2 **22 marks**

(a) The steps in the product design process are:

- idea
- screening
- proposal
- initial decision
- design
- project organisation
- final decision
- implementation
- product launch
- feedback

½ mark for each point, maximum 4 marks

(b) Assumptions will be required for the following at a minimum to assess profitability of the new product offering:

- Expenses – initial and renewal, commission related, investment related
- Discontinuances – full and partial
- Investment earning rates, which may differ for different asset mixes
- Tax rates
- Size of single premium received and any assumed future additional contribution patterns
- Anticipated volumes of new business
- Discount rate
- expense inflation

½ mark per assumption, maximum 4 marks

(c) To set the assumptions outlined in (b), the following could be done:

- Expenses – need to consider company historical experience and what relativities expect this product will have to existing products in terms of costs to sell, administer and invest. Could also seek out some view of how much it is costing others with similar products. If were a larger company with history would be able to rely much more on expense analysis from past if no major changes are anticipated.

- Discontinuances – in this case the company has no useful experience. Could consider results of industry analysis to get a feel for overall view and also consider results for individual competitors who feel may be most comparable to product being designed in terms of features and target market. Need to consider whether any proposed product features will lead to different experience to that observed in the market currently. Again, company with history could consider both their own experience and industry experience.

- Investment Earning and Tax Rates – should be able to make a set of assumptions which are reasonable based on the rpoposed asset mixes and investment strategies. Not usually a significant pricing risk for the company given ivnestment risk passed to policyholders in investment linked policy. Not that different for an existing offeror of product, except they may possibly be more able to consider the specific track record of the investment manager.

- Size of Premium Received and potential for future additions – determine in consultation with those who are looking at the target market, consider others experience if able to access information

- New Business Volumes – determine in consultation with the marketers who should be looking at the size of the total market, distribution strategies, ability to gain product credibility/good ratings with research houses etc

1 mark per reasonable explanation, maximum 8 marks

(d) Measures of profitability that could be considered for such a product include:

- PV profits at risk discount rate / Single Premium
- MoS Profit Margin
- Internal Rate of Return
- PV Profit Margins / PV Expenses

Most useful may be the first two.

1 mark each per measure, maximum 3 marks
1 mark each per explanation, maximum 3 marks

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QUESTION 3 **18 marks**

(a)

EVo = PV (MoS annual profits) + PV (Capital released each year) @ risk discount rate r%

$$= \sum_{t=1}^{\infty} (\text{MoS Profit}_t \times v^t + \text{Capital released}_t \times (1+i)^t \times v^t) \quad @\ r\%$$

i% = fund earning rate on MoS policy liabilities and Capad capital

<u>MoS Profit = Premium + Interest – Commission - Claims – Expenses – Tax</u>
- Increase in Policy Liabilities.

For Unit linked business, this usually simplifies to:
MoS Profit = Interest + Fees & Charges - Commission - Expenses - Tax
(Interest and Tax are applicable to shareholders, not policyholders).

Capad capital $_t$ = (Capital adequacy requirement – Other Liabilities – MoS policy liabilities) at end of year t.

Capital release in year $_t$ = Capad capital $_{t-1}$ – Capad Capital $_t$

The "capital release in year t" is the interaction between capital released as business in force at the start of the year discontinues during the year and capital increases from new business written in the year. The cost of holding capital at the capital adequacy level is determined by the gap between the fund earning rate "i" and the risk discount rate "r" and the duration over which the capital needs to be held.

Using similar formulae, EV_1 will be calculated using the revised embedded value basis and assumptions at 12/2000 and allowing for new business written in 2000.

$$\mathbf{EV_1 = \sum_{t=2}^{\infty} (\text{MoS Profit}_t \times v^{t-1} + \text{Capital released}_t \times (1+i)^{t-1} \times v^{t-1}) \quad @\ r\%}$$

$EV_1 = EV_o$

+ Impact of Change in assumptions (e.g. fund earning rate, risk discount rate, tax, mortality basis, lapse rates, valuation basis)

+ Experience in year (lapse experience and unit growth experience in 2000 compared to expected basis)

\+ Value of New Business in 2000 x $(1+r)^{0.5}$ (Value of future MoS profits from NB written in 2001 plus value of capital supporting NB written in 2001)

\+ Unwind of discount rate (Sum of 2 items: Interest at risk discount rate on first item of EV i.e. PV(MoS profits);
Interest at risk discount rate less fund earning rate on second item of EV i.e. PV (Capital releases))

\- Expected profit and capital release in 2000 (The expected MoS profit and expected capital released in the year)

Marking Guide:

2 marks for EV_0 formulae;
1.5 marks for comments on MoS profit;
1.5 marks for formula and comments on capital releases and capad capital;
1 mark for EV_1 formulae;
1 mark for each of final 5 items in $EV_1 = EV_0$ reconciliation (ignore first item EV_0)
Total marks allocated 11, maximum mark 10.

(b)

Management performance can be assessed by analysing change in EV or MoS profit.

<u>Comments on "change in EV":</u>

- The change in EV measures management performance more accurately because it capitalises the impact of new business written and assumption changes (expenses, mortality, discontinuances, valuation basis). However, profit can be reported prematurely if short term improvements in experience are subsequently reversed.

- The future impact of current management actions can be reflected immediately and fully. For example:
    - improvements in expense levels
    - improvements in mortality/morbidity experience
    - improvements in persistency
    - writing profitable new business
    - writing capital efficient new business products
    - maximising fees and charges

- The EV measures return on capital and can show how efficiently the management team uses the capital supporting the business.

- EV profits are not well understood and are very sensitive to assumptions.

- If the "change in EV" measure was used to assess management performance, the formula shown at the end of part (a) would need slight modification as follows:

    - "Impact of changes in assumptions". Exclude the changes in economic assumptions (risk discount rate and fund earning rate) as these are outside management control.
    - "Impact of changes in assumptions". The main items here are lapse rates, mortality basis, morbidity basis, expense levels and valuation basis. Any one-off items would also need to be included, such as reductions in fees and charges, changes in premium rates, impact of tax changes and enhancement in policy conditions.
    - "Unwind of discount rate". Compare the actual and expected unwind, with management assessed on the difference.
    - "Expected profit and capital release in year". Compare the actual and expected profit and capital release, assess management on the difference.
    - The management would therefore be assessed on:

Impact of Change in assumptions (exclude economic assumption changes)
\+ Experience in year (impact of lapse & unit growth experience in year on EV)
\+ Value of New Business in 2000

+ Unwind of discount rate (show actual less expected)
+ Experience profit in 2000 (show actual MoS profit less expected MoS profit)

Comments on MoS Profit:

- The MoS method spreads the impact of changes in assumptions across future years. Unless the product group is in loss recognition, the impact of change is not capitalised and is spread. Improvements in experience are reported gradually.

- The MoS method reports profit as the service is performed and therefore does not report profits prematurely.

- The MoS method and profits make no allowance for the costs of servicing capital.

- The MoS profits are the actual profits shown in the accounts and are well understood. It is often useful to eliminate the one-off impacts so that the true underlying MoS profits are understood.

Marking guide:

5 marks for EV comments
3 marks for MoS comments

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QUESTION 4 **24 marks**

(a)

The main investigations are:

<u>Check Balance Sheet position</u> **(3 marks)**

- Determine the value of policy liabilities and other liabilities on the margin on services basis and also the liabilities on solvency and capital adequacy bases. The valuations would be as at the current date or at a recent reporting date, with the capital adequacy margins set at appropriate industry levels. The total surrender value will also be determined as part of the MTV in the capital adequacy calculations.
- Determine the market value of assets at the same date, allowing for the disposal value of fixed assets.
- These two steps will give an indication of the balance sheet strength of the company, including the relative solvency and also the shortfall of capital for solvency and for capital adequacy purposes.
- Assess the liquidity position and the suitability of assets backing capital guaranteed business.

1 mark per point, maximum 3 marks

<u>Check value of existing business</u> **(2 marks)**

- Determine the embedded value of existing business, allowing for the value of future profits of in force business and for the net worth. This will give an indication of the market value of the existing business, if a sale or transfer was considered.
- The EV would be calculated by running projections of existing business, using best estimate assumptions, and taking the present value at a risk discount rate of annual profits net of tax.
- The EV should consider the impact of likely higher discontinuances and expense unit costs if the company's solvency position is made public. Such announcements could cause a significant increase in discontinuances.

1 mark per point, maximum 2 marks

<u>Review profitability of new business</u> **(2 marks)**

- Run profit tests for the products open to new business to determine the profitability of new business. The calculations here will be similar to those for the embedded value, except calcuations are carried out from policy duration zero.
- The capital required to support new business should also be investigated.
- This will reveal the impact that new business has on the business: loss-making products should be withdrawn from sale and capital intensive products reconsidered.

- In addition, new business products should be reviewed for any poorly designed or under-priced features or benefits. The likelihood of distributors to continue to support the company must also be considered.
- Consider impact of higher unit costs if sales volumes fall.

1 mark per point, maximum 2 marks

Cash Flow Projection for 3 years **(3 marks)**

- **The business should be projected over the next 3 years, allowing for future new business. The expected premiums, commission, claims, expenses, reserve changes and interest should be determined for each year as well as the capital adequacy capital required to support the business.**
- This will reveal how the financial position of the company is expected to move in the short term. It may show the company is able to trade its way out of trouble.
- Importantly, this exercise should be repeated for various scenarios: e.g. cessation of all new business; reductions in terminal bonuses; changes in asset mixes; increase in reinsurance of risk business; increase in discontinuances.

1 mark per point, maximum 3 marks

Review Experience of Disability income business **(2 mark)**
Carry out experience investigations into the claims incidence and termination experience of the DI business. Current valuation assumptions should be compared with actual rates experienced over the past 3 years. The DI market has been affected by poor experience in the past few years and a strengthening in the valuation basis may be required. Also assess claim and underwriting quality to ensure appropriate standards are being maintained.

(b)
Under the Life Insurance Act section 175, the judicial manager must file a report with the Court that recommends actions in the best interests of policyowners. Actions possible include: transfer of business to another company; allow the company to continue in business with possible changes/reductions to policy values; wind up; other reasonable actions. **(3 marks)**

To expand on the "other reasonable actions":

- If the investigations in (a) indicate the company is unlikely to survive in the future, the judicial manager should look for a prospective purchaser of the business. In extreme cases, the existing policies may need to be reduced (e.g. terminal bonuses cut). The business would be transferred using a Life Insurance Act Part 9 transfer.
- Keep the company under judicial management and cease writing new business. It may be preferrable to keep the company together and allow existing business to run off, provided

the embedded value is positive. The staff would need to be reduced. The company may later merge with another company or be allowed to re-enter the market.

- Continue in business but take the following actions to improve the financial position:
    - reduce the capital requirements by increasing the amount of reinsurance on existing risk business (which is capital intensive)
    - reduce capital by changing the asset mix e.g. reduce the holdings in equities
    - cease writing some new business products, particularly those with low profitability or those with high capital strain
    - reduce expenses by cutting back on staff or on overheads
- Seek alternative sources of capital, eg subordinated loans.

Marking guide: 3 marks for first paragraph as shown above. For "other reasonable actions": 1 mark for first, second and fourth points. 2 marks for third point.

(c)

The whole of life insurance policies could be revised as follows to improve the company's financial position:

- The existing terminal bonus scale could be reduced or restructured so that policy liabilities are reduced. A more onerous action would be to retrospectively reduce reversionary bonus rates so that the current reversionary bonuses are scaled back. In both cases, the reductions in bonus could be applied to all types of policy discontinuance OR only to surrenders, so that ongoing policyholders and "genuine" claims are not penalised.

- Reduce surrender value basis to minimum.

- The terminal bonus method may be preferable to the reversionary bonus method because it is easier to implement, more in line with policy conditions and able to be easily reversed at a later date if the company's financial position improves.

- The considerations here are equity amongst policyholders, policy conditions and policyholders reasonable expectations. The actuary would need to calculate asset shares for the various tranches of business and decide on the most equitable method of scaling back entitlements.

Marking guide: 1 mark for each point, total 4 marks

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QUESTION 5 **15 marks**

The aim of this question is to test the student's understanding of the components in a reserving basis and the impact of reserving on experience.

(a) Data Analysis

The table below shows the earned premium, claims cost (both for new business and total claims) and loss ratios by year and in total.

Year	1	2	3	4	Total
Earned Premium	953	1,173	1,507	1,864	5,497
Claims Cost - New Claims	434	518	675	807	2,435
Loss Ratio	46%	44%	45%	43%	44%
Total Claims Cost	458	581	772	943	2,753
Total Loss Ratio	48%	49%	51%	51%	50%

Students should:

- recognise that earned premium, rather than revenue premium, should be used in calculating loss ratios (1 mark);
- recognise that claims cost includes both claim payments and claims in course of payment reserves (1 mark);
- calculate loss ratios for new claims (3 marks – ½ mark for each year and 1 mark for total experience).

Students may then either:

- calculate loss ratios for total claims (above); or
- assess run-off of CICP reserve (below) (3 marks for either of these).

For the run-off of CICP reserves, the following should hold (approximately):

CICP (total) at end year x * (1 + i) – claim payments (existing) in year (x+1) * (1 + i/2) = CICP (existing) at end year x+1

Therefore,

i = (CICP (existing) at end year x+1 - CICP (total) at end year x + claim payments (existing) in year (x+1)) / (CICP (total) at end year x – 0.5 * claim payments (existing) in year (x+1)) (1 mark)

Calculating this for each year shows that, in order for the CICP reserve to be sufficient, the life office needs to earn investment returns of 17% p.a. in order for the reserves to be sufficient. (2 marks)

Alternatively, the student could assume some level of investment return, say 7%, and demonstrate that this is insufficient for the CICP in year x to support the claim payments in year x+1 and set up the CICP at the end of year x+1. (2 marks)

(b) Reserving Basis and Experience

The reserving basis is insufficient.

No allowance is made of IBNR claims (1 mark);

The CICP reserves are insufficient (1 mark).

The fact that the CICP reserves are insufficient can be determined either by showing that the CICP is insufficient to support claim payments and future CICP, or by showing that the total loss ratio is higher than the loss ratio on new claims.

The CICP reserves are insufficient because either the termination rates are too low or the investment earning rate assumed is too high (1 marks).

The experience has been poor (1 mark).

(c) Shortcomings

Marks should be given for reasonable shortcomings of the analysis, without resorting to comments that simply require more information (eg what is the reserving basis).

Marks should be allocated as ½ mark per shortcoming noted, plus ½ mark for impact that it would have, maximum of 3 marks.

Some shortcomings:

- The portfolio is growing, so there may be some selection effect occurring and thus experience could be worse than shown.

- There is no allowance for IBNR, so the claims ratios will be understated.

- New claims are allocated by date when the claim payments commenced rather than the date incurred. This means that the claims are not properly matched with the premium.

- No allowance is made for claims management expenses. This would result in the reserve being understated.

- The analysis is not being split by rating variables. The impact is that there could be large unders and overs that are being masked by a high-level analysis.

- Claim numbers are not being analysed. The impact is that a few large claims could distort the results.

QUESTION 6 **12 marks**

The aim of this question is to test the student's understanding of the risk management techniques used in risk business, their ability to assess the impacts of changes and their ability to consider new ways to handle risks.

(a) Impact on Ability to Manage Risk

(i) The 3 month exclusion acts to protect the company against anti-selection from applicants who may suspect that they have a particular condition, but have not yet visited a doctor. (1 mark)

If it were removed, the company would expect claims rates to increase at early durations due to anti-selection. (1 mark)

(ii) Automatic blood tests are carried out to:

- detect conditions that the applicant may be aware of but has not disclosed; and
- detect conditions of which the applicant may not be aware. (1 mark)

If they were dropped, the company would face increased risk from both non-disclosure and undetected conditions. (1 mark)

(iii) Of itself, this change would not be expected to have an impact provided the same underwriting standards were maintained. (1 mark)

However, the company would expect to come under pressure from distribution to accept a proportion of substandard cases as standard, resulting in a worsening of experience. (1 mark)

Bonus mark: The company could face pressure to transfer all existing substandard lives onto standard rates.

For both (i) and (ii), 1 mark (total) for comment that anti-selection will be increased if this company is the only one without these protection mechanisms.

Marks as outlined above, maximum 6 marks

(b) Students should propose some reasonable way to address the issues raised.

The proposals should not be in direct conflict with the proposed design modification e.g. "Don't do it" would not be an acceptable approach.

Some possibilities:

(i) Increase use of medical examinations at underwriting.

Implement increased claims focus on early claims

Reduced sum insured on early claims

(ii) Exclusions or reduced sum insured for certain conditions.

Age limits on areas to which applied.

(iii) Implement underwriting audit program to review procedures and acceptances.

Implement program to control interaction of distribution and underwriting – eg all communication through limited number of people.

2 marks per reasonable suggestion, maximum 6 marks