THE INSTITUTE OF ACTUARIES OF AUSTRALIA

LIFE INSURANCE | **2002 EXAMINATIONS**
EXAM SOLUTIONS | **PAPER TWO**

QUESTION 1 **(13 marks)**

You are a consulting actuary and have just received a phone call from an investment banker wanting to engage you to provide actuarial services in relation to a potential acquisition of a life insurance company by their client. She asks you to prepare an overview of the actuarial issues for the bank and their client based on the publicly available information.

(a) Outline the information you would use to prepare your presentation and what you would draw from each. **(5 marks)**

(b) At the presentation, the bank's client asks you to provide some material after the meeting summarising and contrasting the two different potential views of profit that you have discussed - the MoS profit and the change in Appraisal Value. Draft this document. **(8 marks)**

QUESTION 1 – SOLUTION

Part (a)

The information that can be used to prepare the presentation could include:

- Financial statements – MoS data and information on reported profits, balance sheet
- APRA returns – MoS and solvency – MoS data and information on reported profits, capital levels in excess of policy liabilities, contributions of different products
- Investor information – released to stock exchange – potentially includes appraisal value information, should include analysis of business performance
- Statistical returns – information on sales by product and in force by product
- Broker reports – commentary from market analysts on company performance
- Product disclosure documents/rate books – nature and pricing of open product range

(1 mark per piece of information and reasonable explanation for selection)

(Maximum of 5 marks)

Part (b)

Margin on Services reporting is predicated on the release of earnings in line with the provision of service under the contracts held by customers. This is achieved by setting up a reserve for future profit margins that is released over time in line with a profit carrier selected for its alignment with the provision of service. The basis smooths profits over time however where losses are expected to emerge in future these are required to be capitalised immediately.

Appraisal value reporting is based around the total present value of distributable profits expected to emerge for shareholders after including allowance for the setting up of capital adequacy requirements.

Key differences include:

- Capitalisation of all changes in assumptions in AV based methods ie bring forward of impact of changes in assumption to today under AV method whereas impact is spread over the life of the policies in line with the provision of services under MoS unless the product group is in capitalised loss.
- Discount at RDR for AV based method
- AV includes allowance for cost of capital adequacy required to be held
- MoS profit in a given period in most cases (unless something extreme related to new business profitability occurs) primarily driven by existing business whereas AV change can be materially impacted by changes in assumptions related to future sales
- Can be very different timing of profit reported on the two bases
- Both can be volatile – MoS particularly in relation to the impact of investment returns, AV in relation to same but also changes in assumption regarding future experience can have very material impact today

(3 marks for summary of bases, 5 marks for commentary on valid differences and potential impact on results of the different methods)

(Maximum of 8 marks)

QUESTION 2 **(20 marks)**

You are the Appointed Actuary of a medium-sized life office that has recently been taken over by a broad based financial services organisation. The life office has one statutory fund comprised of the following assets and liabilities:

Assets	**$bn**
Fixed Interest	2.3
Equities	0.7
Property	0.1
Cash	0.3
Total	3.4

Liabilities	**$bn**
Investment Account	1.7
Participating conventional	0.5
Disability Income	0.6
Other risk	(0.2)
Tax	0.2

The company has capital and retained earnings of $0.6bn. The excess of the Capital Adequacy Requirement over the Policy Liabilities is $0.4bn.

A new Chief Investment Officer (CIO), with a background in stock broking, has been appointed. He has reviewed the investment portfolios and presented a paper to the Board Investment Committee. In the paper, the CIO is highly critical of the conservatism of the previous management, noting that the asset mix of the investment portfolio was highly skewed towards fixed interest securities. In the paper, he recommends moving the portfolio to a more balanced asset mix by reducing the Fixed Interest exposure by $0.7bn and investing those funds in International Equities.

The Chairman of the Board Investment Committee has requested your written advice on the proposal. Draft your response.

(20 marks)

QUESTION 2 – SOLUTION

This question is driving at the link between assets and liabilities, the nature of different investments and the commercial impact of the proposal. Marks should be awarded for the following points:

Asset / liability matching (Maximum of 8 marks)

- Outline the concept of matching of assets and liabilities – stating that changes in one mirror changes in the other and thus protect the profit and solvency of the Fund (2 marks)
- Identify that moving away from a matched position requires close examination of:
  - the impact on the risk of insolvency (increases) – because asset values may fall but solvency liabilities may not fall by a similar amount (2 marks)
  - volatility of reported profit (increases) because asset values are held at market value and liability values may not change by corresponding amounts (2 marks)
  - capital requirements (increase) because Resilience Reserves increase (2 marks)

(For each point above, 1 mark should be for identification of the issue and 1 mark for saying what the impact will be and why)

Analysis (Maximum of 2 marks)

- The numerical information provided in the question is primarily to provide context around the size of the issues involved, however marks should be awarded for evidence of high level analysis of proposal, utilising asset mix provided – eg identify change in asset mix, provide hypothetical balance sheet if international equities fell by (say) 30% or 50% to illustrate solvency concerns (2 marks)

Asset specific (Maximum of 2 marks)

- Identify that the International Equities investment will generate currency exposure plus equities exposure (1 mark)
- Identify risk management / risk mitigation action that could be undertaken, eg hedging (1 mark)

Liability specific (Maximum of 6 marks)

- Disability Income and Other Risk – all investment risk borne by shareholder (1 mark)

- Investment account – asymmetric distribution of outcome – depending upon product terms and conditions, higher returns may be primarily passed onto policyholders, while the company has the downside risk (2 marks)
- Investment account and par business – need to consider the level of asset fluctuation account or par retained profits – possibly OK for relevant sub funds (2 marks)
- Policyholder expectations – stable returns (1 mark)

Conclusion (Maximum of 2 marks)

Valid points may include:

- Needs additional work performed on asset liability modelling (1 mark)
- May be feasible for some business (eg par and investment account) (1 mark)
- Based on the current capital position, may be a high risk strategy (1 mark)

(Maximum Total of 20 marks)

QUESTION 3 **(15 marks)**

You are the Pricing Actuary for superannuation products for a medium-sized Australian life office. Up until now, the life office has concentrated on individual retail products, but with the trend in superannuation for corporate funds to join Master Trusts, a Product Manager for Corporate Superannuation has been appointed.

(a) Outline the advantages and disadvantages of using marginal expenses in a product pricing basis. **(5 marks)**

(b) The Product Manager has developed a proposal for a new Corporate Superannuation Product. The proposal requires minimal initial outlay, but shows an ongoing fixed cost of $2m per annum for the infrastructure required to operate the business (general management, technical services, etc).

The Product Manager suggests to you that the product pricing basis should use marginal costing. She would like your written response to this suggestion in order to finalise her business proposal to the senior executive for approval.

Draft your response, including an opinion on the proposal to use marginal costing in the pricing basis. **(10 marks)**

QUESTION 3 – SOLUTION

Part (a)

<u>Advantages</u> (Maximum 2 marks)

- Should result in competitive pricing (1 mark)

- Overall check of viability can then be performed by profit testing to see whether the fixed costs can be met from the revenues generated. (1 mark)

<u>Disadvantages</u> (Maximum 3 marks)

- Predicated on there being an existing portfolio to meet the fixed costs (3 marks)

- Measurement of the truly marginal costs is difficult (1 mark)

Part (b)

The response should include comments on:

- The business will initially be sub-scale and unable to support the fixed costs, but the cost of administering each additional member will be relatively small. Reference to competitiveness (market pricing) – rather than marginal costing – should be made.

- Profit testing would need to include the fixed costs of running corporate super because of the need to cover them.

- Further, the business case should consider the need to cover part of the corporate overhead – what is the company's view as to whether all parts of the business should contribute to the corporate overhead?
- Marginal expense analysis is useful in 'what-if' scenario testing and expense budgeting.
- Allocated expenses would be used in the statutory reporting – the impact on reported profit and solvency/capital adequacy need to be considered on that basis

(2 marks per point, or for other valid points)

(Maximum of 10 marks)

QUESTION 4 **(25 marks)**

You are the Product Actuary for a life insurance company that specialises in writing all classes of retail risk products and you have recently received a number of requests regarding specific business ideas.

(a) One of your best Agents has approached you with a business proposition to offer a premium discount and simpler underwriting requirements on Disability Income Insurance to small business owners in his local district.

(i) What underwriting requirements would you normally expect would apply to this group for Disability Income Insurance? (3 marks)

(ii) **What concessions would you consider offering, what conditions would you place on the offer, and what process would you follow in determining your offer? (7 marks)**

(b) The General Manager of Distribution has called you to a meeting with one of your company's senior financial advisers who recently returned from a trip to the USA, where he attended a seminar run for members of the Million Dollar Round Table. Whilst there, he became aware of a new product opportunity that he believes would provide your company with a unique marketing feature and enable it to gain status as an innovative leading company in risk business.

People in the medical profession are regularly exposed to infectious diseases, not all of which can be cured or immunised against. If a medical practitioner becomes infected with one of these diseases then they would have to cease practising and sell their business, as they would otherwise risk exposing patients to the disease. It is pointed out that Hepatitis C and HIV are reportable infectious diseases and that any occupational incident where there is a risk of infection is required to be documented under the Universal Precautions Guidelines.

The issue is that when medical practitioners become infectious, cease practise and sell their business, they often do so quickly, thus resulting in a lower price for the business than they would normally achieve. The provision of a lump sum benefit would enable the practitioner to cover the costs of the business and sell it in a more orderly fashion.

The Financial Adviser is proposing that in addition to the normal income protection benefit provided in the company's product, for an additional premium, the company offers the payment of a lump sum on the diagnosis of Hepatitis C or HIV.

The General Manager believes that this is an excellent opportunity and has asked you to draft a product specification for this rider benefit.

(i) In your product specification, outline what you believe to be an appropriate benefit design including eligibility criteria, underwriting requirements, exclusions, claim criteria, and any limitations to the benefit. (10 marks)

(ii) Outline the factors you would consider in determining a price for the optional benefit and outline the key steps in performing the pricing analysis. (5 marks)

QUESTION 4 – SOLUTION

Part (a) (i)

- medical underwriting - standard requirements based on age, sex, sum insured, medical history, etc. This would include a Personal Health Statement for the life insured, possibly a PMAR, Medical, HIV test, etc (1 mark)

- additional medical underwriting where information in the standard requirements (1 mark)
- non-medical – financial - include income history, etc, to assess moral hazard; occupation; hazardous pursuits, etc. (1 mark)

(Maximum of 3 marks)

Part (a) (ii)

<u>Concessions (maximum 2 marks), Conditions (maximum 2 marks)</u>

- May consider concessions on some of the medical requirements provided some rules around eligibility criteria and minimum take-up can be agreed upon. For example, higher medical limits for 'clean-skin' proposals. (1 mark)

- May consider reducing some financial underwriting terms if eligibility is restricted in some way to members who ought to have strong financial standing (eg extended period in same business, perhaps certain types of business could be included or excluded) (1 mark)

- Would consider offering premium discount after considering profitability, volume and strategic issues, along with anticipated impact of underwriting concessions. (1 mark)

- Likely have an agreed offer close date, and possibly minimum volumes by certain points in time in order for the offer to remain open. (1 mark)

<u>Process (maximum 3 marks)</u>

- Perform analysis on financial implications of offer – including consideration of impact of different retention experience on profitability for each level of concession considered. (1 mark)
- Sales/competitive analysis (1 mark)

- Discuss with Appointed Actuary and also the company's reinsurer(s).

(1/2 mark each, total 1 mark)

- Discuss with Agent to negotiate/explain the company's position. (1/2 mark)

(Maximum of 7 marks)

Part (b) (i)

1. Only cover Occupationally Acquired. To be successful a claim will need to be shown to be the result of an occupational incident. This would require the appropriate reporting and documentation procedures to be in place so that the incident can be shown to be properly recorded. (2 marks)

2. Only cover specific occupations – Doctors, Dentists, Surgeons etc. Not all occupations will have readily available statistics on the historical incidence of occupational incidents to allow measurement of the probabilities.

   (2 marks – 1 for identification of issue, 1 for explanation)

3. Fully underwritten – including blood tests for HCV and HIV. Need to be sure that the life insured does not already have the disease (a reasonably large proportion of those lives diagnosed with HCV were not aware they are carrying the disease), also need to be sure that there is not a prevalence of other risk factors that might increase the possibility of contracting the disease from another source (eg lifestyle activities such as intravenous drug use) (2 marks)

4. Ensure appropriate financial underwriting to be sure that the amount applied for is not excessive compared to the need (urgent sale of business). (1 mark)

5. Claim event needs to be appropriately reported. For a claim to be identified as resulting from the incident there first needs to be a negative test for the disease achieved within a short time of the event (so that the disease would not be showing up if it had just been contracted) – this is usually within7 days of the incident. Then there needs to be a positive test result within a maximum period of time so that it can be reasonable to consider the cause of the positive result was the incident – this is usually 3 to 6 months as modern medical tests can detect HCV or HIV within this period. (1 mark)

6. Limit cover to say $200,000 – potential moral hazard if large amount. Someone who is aware they have contracted the disease through other means may manufacture an occupational incident if they believe it can result in a large financial gain.

   (2 marks- 1 for identification, 1 for detail of limitation of cover)

(Maximum of 8 marks)

Part (b) (ii)

Pricing would involve 3 elements:

1. Risk of exposure via an occupational incident (event)

2. Risk that the patient with which the occupational incident occurred has HCV or HIV (exposure)

3. Risk of contacting the disease if exposed (contraction)

(3 marks for 1-3)

4. Expense and commission allowances (1 mark)

5. *Reserving Requirements* (1/2 mark)

6. *Profit loading* (1/2 mark)

7. *RDR* (1/2 mark)

8. *Key steps in pricing* (1 mark)

(Maximum of 5 marks)

QUESTION 5 **(11 marks)**

You are the Capital Management Actuary for a medium-sized life office writing risk insurance business in Australia that has been recently purchased by a bank. The bank's management is very risk averse and desires a stable flow of reported profits from year to year. Following the purchase, the bank has limited capital available and is keen to free up capital employed in the business so that it can be used to fund further expansion.

The new CFO, who transferred over from the banking business, has read in the media about the reinsurance arrangements employed by HIH, and wants to ensure that appropriate reinsurance arrangements are in place for the life business. He has no prior knowledge of reinsurance and is, therefore, reliant on you for advice on the potential opportunities to use reinsurance to smooth profits and/or reduce capital requirements.

He has asked you to consider potential reinsurance strategies that may reduce the capital requirements of the business and to draft a paper outlining the alternatives available. For each of the proposals in your paper, make sure you consider the impact of the proposal on the bank's key measures, reported profits and capital position.

(11 marks)

QUESTION 5 - SOLUTION

- As this is a report to the CFO some effort should be made to present the response in an appropriate format and style.

(1 mark)

Description of reinsurance **(3 marks in total)**

Reinsurance can involve a transfer of risk, be it mortality, morbidity, investment, lapse, sales, expense or miss pricing. There are a range of forms of insurance (surplus vs quota share, coinsurance/ original terms v risk premium, non proportional forms of reinsurance).

Mortality and morbidity are standard transfer of the sum at risk by determination of a retention (possibly zero) and ceding a proportion (possibly 100%) of the business written above this level.

Alternatively it may involve ceding a proportion (less than 100%) of the business written up to a retention and ceding 100% of the remainder. For this a premium is paid.

Depending on the type of product the investment performance of a product can be reinsured so that the reinsurer takes the investment risk to achieve the interest rate guaranteed on a product.

Types of Reinsurance (1 mark) - description of the basic forms of reinsurance and how they differ and are used. This should include surplus vs. quota share, co-insurance /

original terms vs. risk premium, and non-proportional forms (Catastrophe, Excess of Loss) etc.

Description of how reinsurance commissions and premiums and selection discounts work (1 mark)

Description of how much of claims the reinsurer covers ie retentions (1 mark)

Capital Effects (4 marks)

Relevance of AS 2.02 and AS 3.02 to the capital effects of reinsurance and that reinsurers have to be registered life companies under the Life Act in order for reinsurance to be recognised under these standards (1 mark)

Description of how reinsurance can be used to reduce Solvency and Capital Adequacy requirement – requirements can be calculated taking account of reinsurance arrangements in place provided the above requirements are met (1 mark)

Description of financial reinsurance and how it works - By paying a large initial commission or giving a premium holiday for some initial period the reinsurer is effectively lending money to the direct office. For this loan to be considered reinsurance the repayment of the amount must be after all other costs are met (effectively out of the profits generated by the product). So if the product fails to make a profit either due to higher expenses, higher lapses, higher claims, poor investment performance or miss pricing then the funds from the reinsurer support this cost without a need to repay the reinsurance. This is the basic nature of financial reinsurance. Often the cost of reinsurance is less than the cost of capital from internal sources and so reinsurance can be used to gear up the internal rate of return that can be achieved. (1 mark)

Use of reinsurance to reduce new business strain, including how this works - by using reinsurance the company transfers the risk to the reinsurer, this means that the company doesn't have to hold as large a reserve and frees up capital for other purposes (such as funding business growth). The reinsurance assists in the release of capital and funding of the new business strain. (1 mark)

A response that makes no mention of financial reinsurance should be considered deficient.

Profit Effects (3 marks)

Commentary on impact of reinsurance under MoS – where the incidence of profit is not affected by reinsurance and the planned profit still emerges smoothly (1 mark)

Reinsurance effectively results in the sharing of profit between the life company and the reinsurer (1 mark)

Discussion of the effect of reinsurance on planned amount of profit – the planned profits will be reduced to the extent that profits flow to the reinsurer (1 mark)

Commentary in relation to the reduction of profit volatility through the use of reinsurance - by using reinsurance the direct office can cap the size of any one claim (surplus) and thus reduce the distribution (and hence volatility) of claims costs from year to year. (1 mark)

Bonus mark was given for description of other benefits to be derived from reinsurance – such as claims assistance, technical assistance, pricing advice

Bonus mark was given for description of alternative methods available to the company to manage capital and profit issues mentioned in quesiton

(Maximum of 11 marks)

QUESTION 6 **(16 marks)**

You are an actuary responsible for the Appraisal Value calculations in a large financial services organisation. Historically Appraisal Values have only been determined for the life insurance entities in the group. Recently, you have been asked to investigate preparing valuations for the funds management entities within the company on a consistent basis with those for the life entities.

Your first step is to meet with the Financial Controller (an accountant) for the funds management entities to discuss the concept, including what could be done and the information required. As preparation for your meeting, you decide to plan the process and identify issues that you expect to emerge, as well as potential differences to the work you have done on the life insurance valuations.

(a) Outline your initial plan, documenting at each step what issues you expect may emerge. Make sure that you consider each of the components of the Appraisal Value. **(5 marks)**

(b) Identify, with reasons, the assumptions you expect to be most important to consider in the derivation of each of the components of value in the environment described. **(4 marks)**

(c) You have been given some initial information on the businesses to help with your preparation for the meeting. Given the information below, estimate the appraisal value of the business and outline the reasoning behind your approach as well as the results.

Net Assets	**\$10m**
Present Value of Future Profits - Existing Business	**\$50m**
Present Value of Future Profits - Next Year's Sales	**\$10m**
Average New Business Growth Rate (1996 - 2001)	**5%**
Planned NB Growth Rate (2002 +)	**10%**
Capitalisation Factor @5% sales growth rate	**12**
Capitalisation Factor @10% sales growth rate	**9**
Current Year Earnings	**\$20m**
Funds Under Management	**\$5 billion**

(5 marks)

(d) The Financial Controller is sceptical about the approach. Describe for her how appraisal values of life companies have been used. **(2 marks)**

QUESTION 6 – SOLUTION

Part (a)

The components that are required are:

1) Net Worth
2) Value of Existing Business
3) Value of New Business

Considering each in turn:

1) Net Worth – definition of capital requirement important as this represents free assets above this amount.
2) Plan steps will therefore be to obtain accounts and also ascertain capital requirements.
3) Value of Existing Business – reflection of the business currently on the books and the present value of future profits expected to generate.
4) Plan steps require a projection of expected future profits i.e. build model of products, information on which to set assumptions including a discount rate.
5) Value of New Business - reflection of the value of business to be sold in future and the present value of profits expected to be generated i.e. build model of products and assumptions related to product profitability and sales volumes in particular the sales growth rates for the business.
6) Plan steps require a projection of future product profitability and information upon which to set assumptions, including business plans, expected profitability

1 mark for components of appraisal value

4 marks for coherent plan – covering each of the components as well as the overall need for projections

Part (b)

Key assumptions will be:

1. Level of profitability – including consideration of:

   - fees assumed to be received now and in the future;
   - expense levels; and
   - the length of time the business is retained i.e. lapse rates

2. Risk discount rate

3. Volumes of business expected i.e. key factor will be sales growth rates assumed

2 marks for discussion of profitability issues
1 mark each of RDR and business volumes
Bonus mark for discussion of cost and capital

(Maximum of 4 marks)

Part (b)

Net Worth	\$10m
VIF	\$50m
VNB = 10m x NB Multiple(somewhere between 9 and 12, say 12)	\$120m
AV = sum of the above	\$175m

One mark for net worth
One mark for value of in force
2 ½ marks for deriving value of new business – 1 ½ for multiple and discussion, 1 for discounted profits
½ mark for total AV

(Maximum of 5 marks)

Part (d)

- Management performance monitoring
- Shareholder reporting
- Transaction values
- Management remuneration

½ mark for each valid use of Life Avs

(Maximum of 2 marks)

END OF PAPER TWO SOLUTIONS