Institute of Actuaries of India

Subject SA2 – Life Insurance

October 2009 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable

Question 1

Marks

a) Generally accepted supervisory reserving principles:

Marks are awarded to the extent the candidate identifies the established principles and relates these to the prescribed valuation principles in India. Note that these principles are part of the Core Reading for ST2 and as the syllabus for SA2 states '*Candidates can expect to be examined in aspects of general principles developed in Subject ST2 as well as in the Indian specific aspects developed in this subject*'.

In general all the principles identified below are incorporated into Indian principles with the possible exception of warnings on the capitalisation of margins in gross premiums. In some areas the Indian principles go further eg in requiring seriatim valuations and that the reserve for any one policy shall not be negative or less than its surrender value.

- All liabilities arising out of life insurance contracts can be met
- Prudent actuarial valuation of all future liabilities for all existing policies, including:
    - guaranteed benefits including surrender values
    - the amount of the reserves for each policy should be at least as great as any surrender value guaranteed and negative
    - bonuses already been guaranteed
    - options available to policyholder
    - non-unit reserves for unit-linked policies
    - future bonuses
    - policyholders' reasonable expectations
    - expenses including commission
    - taking credit for the premiums due to be paid under the terms of each policy.
- Should include an appropriate margins for adverse deviation
- Should take account of the nature, term and method of valuation of the corresponding assets
- Appropriate approximations or generalisations should be allowed.
- Rate of interest to have regard to the yields on existing assets and the yield expected on sums to be invested in the future.
- Demographic, withdrawal assumptions and expense assumptions should be chosen prudently,
- Where no explicit allowance is made for future bonuses the rate of interest should be lower than it otherwise would be by an appropriate amount.
- The method of calculation of the reserves from year to year should recognise profit in an appropriate way over the duration of each policy and should not be subject to discontinuities arising from arbitrary changes to the valuation basis.
- Life insurance company should disclose the methods and bases used in the valuation.
- Allow for the possibility of the company ceasing to write new business (included in GN1)
- Where a gross premium valuation method is used care needs to be taken to allow for the fact that the valuation method will capitalise differences between the interest and mortality assumptions of the valuation and those assumed in the calculation of the office premium.

b) Capital related measures

- Insurance supervisors typically require that a life insurance company maintains at least a specified level of solvency capital.

- Provides an additional level of protection to policyholders.
- Provides a staged plan for supervisory intervention 'Prompt Corrective Action'.
- Possible frameworks include:
    - Empirical system (as followed in India) related to quantum of premiums, claims, reserves or sums at risk
    - Risk based capital where steps are taken to relate the amount of capital to the level of perceived risks of mortality, morbidity, investments, operations etc
    - Capital adequacy and the ability of the company to finance future new business or to run of existing business in the case of closure to new business
- Indian situation:
    - Demonstrated knowledge of general structure of Required Solvency Margin as set out in the ARA Regulations but a recitation of all numerical values of factors was not required
    - Two factor system – first factor applied to Reserves, second factor to amount at risk
    - Factors vary by class of business – non linked, linked and health
    - Further sub classes within overall class with particular reference to guarantees
    - Available Solvency Margin determined as excess of assets over policy and other liabilities
    - Certain assets set to a value of zero eg furniture and fixtures
    - Available Solvency Margin is compared with Required Solvency Margin to determine Solvency Ratio
    - IRDA expects the Solvency Ratio to be at least equal to 1.5

c) Comparison between Reserves and Solvency Margin

- Reserve adequacy needs to be assessed in the context of Solvency requirements; adequacy of solvency margin cannot be assessed in isolation of reserving requirements.
- Practice on relative balance between components varies between countries
- In some reserves are set up on a relatively weak basis but with a requirement for substantial solvency margin determined using risk based capital techniques.
- In others reserves are set up on a relatively strong basis but with a relatively small solvency capital requirement not closely related to the risks borne by the company.
- India is more in the first category eg Guidance on Margins for Adverse Deviations within reserves states the use of a low MAD may mean that the reserve will be insufficient to provide for policyholders in a quite plausible adverse scenario, which, if it were to lead to policyholder loss, would be professionally abhorrent.
- Required Solvency Margin is based on simple factors which have little regard to the specific nature of risks in the company.

d) mbedded Value, stakeholders and insights

- Represents the value of the future profit stream from the company's existing business
- Plus value of net assets separately attributable to shareholders.
- Stakeholders are shareholders, analysts, management and staff.
- Insights
    - Embedded value reporting gives insights into realistic profitability compared to the profit reported under a prudential supervisory basis or even IFRS
    - Intrinsic value of the company in the context of merger and acquisition activity
    - Value added by new business relative to the value of in force business
    - Contribution to shareholder profits from participating business relative to non participating business

e) Reasons for analysing changes in Embedded Value

- Important part of a company's control cycle.
- More realistic nature of the investigation compared with an analysis of statutory surplus makes it easier to interpret results.
- May help the redesign of contracts or to revise bases either for profit testing or for the embedded value itself.
- Disclosure of an analysis is required under minimum disclosure guidance
- Reconcile opening and closing embedded value
- Revision of bases by comparing actual experience against expected
- Determine value of new business written in the year
- Identify the sources of profit and loss and action to take further advantage of profitable business or limit future losses
- Identify unprofitable contracts so that they can be redesigned or repriced.

f) Format of Analysis of Variance for EV and Explanation of Components

- *Opening Embedded Value*
- Expected return on free surplus
- Return on in-force business
    - Expected return
    - Experience variances
    - Operating assumption changes
- New business contribution
- Development costs
- *Operating return before tax and exceptional items*
- Investment return variances
- Effect of economic assumption changes
- Exceptional items

- *Return on EV before tax*
- Attributed tax
- *Return on EV after tax*
- Capital raised
- *Less* Capital distributed
- *Closing Embedded Value*

Explanations

- Expected return on free surplus
    - Free surplus is assets allocated to in force business but not required to support the in-force business
    - Shareholders' surplus may be in par fund where there is a question of determining shareholders' entitlement.
    - Investment return on these assets not included in the value of the in force business,
    - Actual investment return split into two parts with the return here being determined from an expected investment return assumption consistent with the assumptions used to value the in force business,
    - Difference between the actual investment return on the assets and this expected return should be included in the "Investment return variances"
- Expected return on in-force business
    - Expected change in the value of the in force business over the year using start of the year assumptions
- Experience variances
    - Impact of differences between actual and expected experience over the year on the surplus emerging during the year and the value of the in-force business at the end of the year.
    - Experience variances depend on the order in which each source is analysed; no uniquely correct method but a company would not usually change the method from that used in previous analyses
    - The projection approach involves the following steps:
        - (i) Assets allocated equal to the value of the liabilities and the capital required at the beginning of the year.
        - (ii) Assets and liabilities projected to end of the year using the beginning of the year assumptions
        - (iii) Profit emerging during the year and the value of the in-force business at the end of the year are calculated using the projections from (ii) and the beginning year embedded value assumptions.
        - (iv) Steps (ii) and (iii) repeated changing one of the items of experience from the expected value to its actual value.
        - (v) The recalculated profit and value of in force at the end of the year, less the corresponding amounts from step (iii), gives the contribution from the item of experience.
        - (vi) Steps (iv) and (v) are repeated for each item of experience.
- Operating assumption changes - recalculate the future profits from the end of the year using

revised end-year bases.

- Impact of changes to each element of the valuation basis and embedded value basis should be identified separately.
- Impact of changes to the economic assumption in the embedded value basis must be identified separately and excluded from the operating return in the analysis.
- New business contribution - assessed by projecting future profits from new business, including appropriate allowance for the full expenses incurred in acquiring the business

g) Unprofitable new business on EV basis

- Company has been expanding in recent years by opening new offices and agents
- Opening new offices and recruiting agents incurs costs and there is invariably a delay between incurring these costs and before new offices have their complete complement of licensed agents
- Even then agent productivity often takes time to reach its 'ultimate' level
- Result is that current unit acquisition costs are relatively high for an insurer with newly opened new offices
- EV methodology uses full expenses in acquiring new business to determine new business contribution in the current year
- This high level of unit costs reduces the apparent profitability of new business which could be negative in extreme cases

h) Assessment of structural value of new business

- Expanding overall number of offices and agents results in additional costs not immediately covered by value of additional sales – initial unit acquisition costs will be high
- Need to ensure that productivity of new offices and agents will increase over time so that the initial 'capital' investment is repaid in due course – unit costs will progressively fall
- Products can be priced assuming a projected level of unit costs considered to be attainable over a reasonable period of time and sustainable at those levels barring further expansion
- EV report can include supplementary information ie the new business contribution for the year determined using the projected level of expenses

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Question 2

a) AA Considerations

- Ensure that the business of the company is conducted on sound financial lines
- Have regard to Policyholders' Reasonable Expectations (PRE).
- Maintain the highest professional standards envisaged by the Institute of Actuaries of India
- Consider in the light of previous experience whether acceptance would be in line with proper professional behavior and standards.
- Not to act if that individual does not have relevant appropriate knowledge and practical

experience; if not recourse to an actuary who has such knowledge and experience

- All stipulations specified under AA Regulations are complied with eg residence, employee status, CoP, age.
- Access to the Board of Directors in general and the Principal Officer in particular
- Access to all relevant information so that the full range of duties and obligations can be carried out satisfactorily.
- Financial interests in the Insurance Company not such that material conflict of interest would arise

b) Yearly Renewable Term – Design Issues and Considerations

- Profitability
  - Will need to be assessed in accordance with the company's established product pricing targets
  - May need additional assumptions to be developed eg expenses if this is a significantly different product form for the company
  - Term insurance in general tends to be highly competitive and it may be necessary to accept a less than full contribution to overhead within the pricing
- Marketability
  - Products offered by competitors
  - Customer willingness to accept increasing premiums over long periods
- Suitability to meet customer needs for defined target market
  - Offers benefits of low cost life insurance in the short term
  - But affordability could deteriorate significantly as age advances so that offer of long term protection becomes illusory
- Competitiveness
  - Review competing products – benefits, rates, guarantees associated with rates, expiry ages
  - Also need to consider commission
- Method of distribution
  - Agent acceptance given initial commission is related to a relatively low premium
  - Product is externally simple and may open up new distribution / target market opportunities
- Financing requirement
  - High Required Solvency Margins for term insurance products generally in India
  - Initial expenses relatively high as a proportion of first year's premium
  - Need to reserve for cost of embedded option to renew
  - Reinsurance might help
- Onerousness of any options or guarantees
  - No publically available data of policyholder behavior data in India for products of this type
  - No publically available data on mortality deterioration following selective lapsation

	o Whether or not rates are guaranteed is a relevant factor
• Sensitivity of profit	o Likely to be sensitive to implicit or explicit assumptions as to mortality experience
• Extent of cross-subsidies	o Experience among lives of a given age who recently effected policies could be markedly different from those who effected many years ago o Same rates might be charged but not necessarily a cross subsidy as existence of reserves needs to be considered as well
• Administration systems	o Special system builds may be needed to cope with increasing premiums o Actuarial systems also likely to require enhancements – reserves more complicated than unexpired risk plus IBNR
• Service standards	o Special training for staff particularly in relation to collecting increased premiums each year
• Company reputation	o Should enhance reputation if perceived as a straightforward and transparent form of life insurance o May also be seen as innovative depending on other offerings in the market
• Treating customers fairly	o Customers will not be expected to be singled out for rate increases as a result of deteriorating experience (assuming rates are not guaranteed) o Product likely to be positioned as protecting ability to continue life insurance notwithstanding deteriorating health and so policyholders might expect to be a premium not greater than those for new policies being effected at that time and fully underwritten
• Level of risk	o Limited investment related risks although reserves are not necessarily trivial o Major risk likely to be in mortality experience related areas including impact of policyholder behaviour
• Underwriting philosophy	o Ideally relatively stringent with low non medical limits o In practice this could impact acceptance by agents o Also adds to first year's costs against a relatively small premium
• Reinsurance terms and capacity	o Significant reinsurance support likely to be necessary for a risk oriented product of this type
• Regulatory constraints	o Any distinctly new product form in India is subject to special scrutiny by the IRDA so that early discussion with the IRDA is desirable o Contract may be interpreted as a series of short term policies as opposed to a long term policy in which case commission

constraints could arise

- Premium issue referred to in next part of question is a further example of potential IRDA special attention.

c) Premium rates – workable, sound and fair

No correct answer as to whether rates should be the same on renewal as for new policies effected at the same age; marks awarded for a definite conclusion expressed and the stated approach to dealing with the issues that arise.

- Different premium rates
  - Marketing incentive to renew if renewal rates are lower
  - Lower rates reflect lower costs on renewal compared to new policy
  - But mortality might be higher for renewed policies as effect of underwriting wears off
  - Higher mortality aggravated by selective withdrawals as premium rates increase and cover becomes less affordable
  - Higher rates in theory could compensate for mortality
  - But good lives coming up for renewal would be incentivised to apply for a new policy, undergo underwriting and benefit from lower premium rate
  - Options in general should be paid for by those who are entitled to exercise the option not those that renew it
  - Premium rate for new policies at a given entry age needs to take into account both experience and rates to be paid at renewal ages
  - How to determine rates at renewal ages? These might turn out to be a function of number of years since policy was first effected as experience of renewing lives might be expected to progressively change.
  - Thus premium rate scales could extend beyond new policies and 'renewers' ie to renewers one year ago, two years ago, etc. with resultant complexities.
  - On practical grounds might consider aggregating renewers.
- Same Premium Rates
  - Generally simpler with only one scale
  - No incentives for good lives to lapse and reenter
  - But no particular incentive to renew (except for those whose insurability had deteriorated)
  - How to allow for increased mortality for renewers?
  - How to give benefit of lower expenses on renewal
  - Practical approach to determining rates might be to determine rate for maximum entry age first taking into account all future benefits, future costs and rates that will apply to renewers only
  - Then step back one year at a time to determine rate for new entrants taking into account rates already determined for future years.
  - Projected mortality could be taken into account ie deteriorating as a result of selective withdrawal but value of future premium rates is known

d) Factors driving capital requirements

- Commission and other acquisition expenses – high compared to first year's premium as this is a long term contract with expenses to be amortised over term to age 70
- Initial expenses include a fixed element in respect of processing cost but absolute amount of first year premium is small
- Required Solvency Margin for term insurance is relatively high; it is related to sum insured and can be a large proportion of first year premium at low entry ages
- Reserves need to be created in early years to cover the cost of deteriorating mortality in future years as selective withdrawal takes place.

e) Shareholder return

No correct answer as to how this is done but candidates are expected to appreciate that this is a private insurer operating in India at the present point in time. Shareholders / promoters will expect an appropriate return driven by market conditions and alternative uses of capital. Candidates are expected to be able to develop a coherent rationale for their conclusion.

- Projected cash flow techniques are used to price products
- For this purpose need to increase reserves and maintain a Solvency Ratio at the level mandated by IRDA is taken as a use of cash
- All elements of experience are projected – premiums, death claims, lapses, expenses, changes in reserves and allowance for solvency margin, interest on cash flows
- Pattern in normally a negative in first year followed by positives in subsequent years
- Pattern can be used to determine a shareholder IRR; cash flows can also be discounted at an appropriate risk discount rate to produce an NPV
- Changing the premium rates will change the IRR / NPV and this can be done until a satisfactory IRR / NPV is obtained
- Shareholders expect a return equal to the risk-free rate plus a risk premium and this can be used to determine a risk discount rate to determine NPV or a target IRR
- IRR method can produce results that are not helpful if a product uses low amounts of capital or payback is quick; not likely to be so in this case so IRR preferred
- CAPM is a potential theoretical approach to determining target IRR ie risk free rate plus equity risk premium
- Risk premium depends on riskiness of proposal
- Life insurance generally may be expected to have a *beta* greater than one as it is a relatively new industry with, has experienced considerable turmoil recently and is generally associated with deferral of profits and complex financial reporting arrangements
- In addition this product specific risks - lack of historical data on which to base assumptions, significant guarantees and policyholder options and an untested market.

- A risk free rate was 7.0%, a standard equity risk premium 5% with a beta of 1.5 for life insurance would result in a return of 14.5%.
- To this might be added additional allowance for product specific risks, say 5% giving a target return of 20%, say.

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Total Marks **[100]**

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