# Institute of Actuaries of India

## Subject CA1-II – Actuarial Risk Management

# May 2015 Examinations

# INDICATIVE SOLUTIONS

**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.

**Solution 1:**

There is a need to regulate any market as it builds a healthy environment for the business to grow

Financial products are not tangible....

.... they are more complex to understand by common man, which may lead to a higher possibility of mis-selling or fraud

A good regulatory system ensures confidence in the financial system as a whole by guarding against dangers of problems in one area spreading to other parts of the system, and the damage that would be done by a systemic financial collapse.

To compensate for any asymmetries that might exist in financial transactions, for example asymmetries of:

- Information
- Expertise
- Negotiating strength

The need is greater than in other markets because:

- Companies failure elsewhere in the economy are likely to be less contagious
- Financial markets are long term and have significant impact on the future economic welfare of individuals

**[4 Marks]**

**Solution 2:**

A unit linked structure is more flexible in

- Benefit levels to choose- life cover could be set at desired levels for a given premium
- Investment fund options across risk spectrum
- Premium levels can be flexible- premium holidays, top ups etc

There is more transparency from the customer's perspective as the charges and deductions from the premiums are known which is not the case in a conventional contract.

... where it is difficult to map proportion of premium going towards purchase of life cover, cover expenses etc. under a conventional structure. It is less transparent.

Could offer a higher return than a without profit endowment over the long term provided of course appropriate investment choices are made by customer.

More over, in case of without profit endowment, company is likely to take a cautious approach to investments and hence be prudent in pricing thereby impacting returns to customers.

charges could be variable in a unit linked product and not guaranteed and charges can be set competitively.

In unit linked, with more investment fund options like pure bonds to pure equity funds, it caters to customers with a range of risk appetite and enables the opportunity to switch between asset classes depending on life stage

The surrender terms in a without profit endowment plan could be unattractive as companies try to avoid selection (surrender in a high interest rate environment). Companies will also alter surrender values frequently reflecting market conditions.

In UL surrender penalties are usually known well in advance and hence it is easy for a customer to compute surrender value that he could get.

Hence the policyholder can choose when to surrender the policy depending on the fund value.

[**4 Marks]**

**Solution 3:**

| Advantages of formula method | Disadvantages of formula method |
|---|---|
| - Simple to apply<br>- Simple to understand and explain<br>- Less time consuming<br>- Always useful to check the pricing numbers from any other method<br>- Quick for simple products like one year contracts | -<br>- Can't explicitly model certain situations, like<br>• Guarantees and options<br>• Reserving requirements<br>• Solvency capital<br>• Cost of capital<br>• Specific profit criteria<br>• Complicated benefit structures<br>• Unit linked products<br>• Multiple decrements<br>- Can't perform any complex scenarios |

**[5 Marks]**

**Solution 4:**

The amount of information published by company would depend on local regulatory, accounting disclosure requirements.

Sometimes, it may not be possible to get information from published accounts and hence other sources if available should be used.

Factors to be considered are

Accounting policy relating to

- Recognition of expenses- acquisition and maintenance
- Depreciation of fixed assets etc.
- Treatment of taxes, items like pre paid expenditure
- Accounting of unlisted investments
- Policy relating to bad debts

- Accounting of special investments like derivatives, swaps,
- Changes In accounting policy compared to previous year and the impact of same
- Good will/other intangibles in the books of accounts
- Contingent liabilities and claims under litigation
- Foreign liabilities and assets

Business information

  - Business volume across various line of business (if accounting information at segmental level is available]
  - Exposure to various geographies to understand portfolio concentration risk, diversification across business lines, geographies
  - Major distribution networks, distributions costs,

Asset valuation methodology

- Basis used for assets valuation should be considered
- How does it treat realised and unrealised capital gains/losses ?
- if assets are valued at market value they are likely to be volatile, so current market conditions should be considered.

Liability valuation methodology

- The basis used to value the liabilities such as setting up of Incurred But Not Reported, Unearned premium reserve, Unexpired Risk Reserve, claims o/s should be considered.
- Actuarial certification of reserves if a part of financial statements should be considered including the model/assumptions used
- Any actuarial judgement in reserving etc.
  Any changes in reserving assumptions/method observed compared to previous year

- We may have to look at the notes at the end of the accounts, to see if there is any qualifying statements by the auditors

- The accounts may be distorted by exceptional events, such as:
  - Large/catastrophic losses or
  - a redundancy exercise or
  - merger/acquisitions/exceptional expenditure
  - Significant one off expense like branding, new product launch etc.

which needs to be considered when understanding results

Spot Trends

- Accounts of 1 year in isolation may not give a clear picture. Trends over time is more important.
- See at least last 2-3 years accounts, to spot any trends
- Trends again will be distorted because of changes in reserving basis, Accounting policy, one –off items and hence needs to be allowed

Reinsurance

  - Level of retained premium
  - Information relating to reinsurance treaties if available
  - Credit rating of reinsurance counterparties
  - Information on reinsurance receivables, ageing of receivables,

Comparison with other companies

- The accounts should be compared with similar sized companies writing similar classes and having similar mix of business

- The extent of reinsurance held may also impact the accounts and companies with similar reinsurance should be compared
- See various ratios like operating ratio, commission to premium income, claims ratio, expense ratio, combined ratio, PE ratio, etc over a couple of years and comparing with other similar companies

**[12 Marks]**

**Solution 5:**

Factors the insurer needs to take into account are:

- Customer needs – does it meet the needs of the target market

- Level and form of benefits – providing real returns might be innovative idea and might be a new in the market and meet customer requirement of hedge against inflation
- Onerousness of guarantees
    - Stochastic modelling to be done to decide at what level x% should be fixed to keep the guarantee manageable
    - Evaluate the guarantee against the standard version of annuity product guarantee. Since this product has a guarantee pricing may look unattractive in a high interest rate scenario
    - Suitable investment policy needs to be designed involving investment in derivatives to protect against fall in equity values to meet the guarantee.

- Profitability - it should meet company's internal profit criteria

- Marketability
    - Being an innovative product, marketability can be enhanced; as you are the first in the market
    - Providing real annuities with a down side protection is a win-win; it should make the product more marketable than the standard annuity products
    - However, it could be perceived by some as complex and may prefer the standard guaranteed annuity especially in a high interest rate scenario
    - Expected sales volumes to be projected in consultation with the sales teams
    - Marketability may also depend on the reduction x%. Higher x% lesser the product will be marketable.
- Competition
    - it may be a new product in the market, but if it works well, may get replicated by the competitors.
    - Annuity rates should compare with the standard annuity products in the market otherwise it will be difficult to sell
- Regulatory requirements
    - Does it meet all regulatory norms prevalent in the market

  - Will the regulator approve such a product; depends on how the insurer is able to manage the investments and guarantees.
- Financing requirements , reserving requirements– how capital intensive is this product, especially due to the guarantee in the product

- Risk characteristics – the general risks in an annuity product would apply along with specific other risks. Like:
  - Increasing longevity
  - Lower than expected investment returns from equity market
  - Higher than expected expenses
  - Any anti-selection risk associated with annuity products
- Investment risk
    - Index that needs to be chosen, (for eg., a popular index of 30 stocks which could be more volatile or a large index with 100 stocks which could be less volatile)
    - How the investment will be matched- replicate index or a more narrow approach of investing in fewer stocks which brings its own risk;
    - investing in derivatives to protect from downside , cost of investing, accounting issues, capital requirements, counter party default risks.
    - Invest in index-linked mutual funds (if allowed) or investing in equities in the same proportion as the index, cost and benefit implications of same, in which case if index changes the portfolio will need to be changed
    - how will the risk be managed, using derivatives

  - risk of mis-pricing: as there would be limited credible data available in terms of annuitant's table or historical stock market returns to accurately price the product. Or if data is available it may not be up to date or relevant.
  - Higher or lower business volumes
  - Poor performance of equity index over a period of time, could lead to a lower annuity being paid and making policyholders unhappy and hence the product becomes unattractive.

- Cross subsidies – would there be any cross-subsidy and how sensitive would it be to the mix of business in that case

- Consistency with other contracts – especially the standard annuity product the company must be already selling

- Administrative systems - would it be a challenge to administer the new annuity in the existing system. Any development cost and does the new business expected justify the extra work and cost.

**[12 Marks]**

**Solution 6:**

**(i)**

The actual price may differ from the theoretical cost due to:

Market factors:

- A given distribution system may allow it to sell it above the theoretical price

- May be there is no competition on price in the given market, limited providers
- Price could be lower due to economies of scale; higher volumes expected
- This product must be giving lower contribution to the fixed costs or profits
- Highly competitive market, so the actual price needs to be kept below the cost to stay in the business. This could be due to the underwriting cycle
- It may be a loss leader.
- In order to enter a new market, or help in cross sell other products to the customer, which is profitable
- The actual price could be deliberately kept higher or lower for a given product to make it attractive compared to similar product with the company. For example, single premium and regular premium of the same product; regular premium could be made relatively more expensive in order to encourage more single premium policies.
- In some markets the price can be regulated- tariff rates.

**[5]**

**(ii)**

**a)** possible sources of data could be:

- Company's own data
- Reinsurer's data
- Industry tables, if any
- National statistics
- Any research or reports published
- Statistics from other countries, if there isn't enough information in your country
- competitors data, data published by regulators

**[3]**

**b)** Adjustments that are required to be made

- If the company had enough of its own data, maintained with the smoker, non-smoker classification, then that should be the best
- If many years data is available, ensure the period of investigation is taken in such a way that data is homogeneous, no major change in policy conditions in this period, or underwriting or claims handling processes.

- If not enough company data, then industry standard table should be taken and suitable adjustment made for underwriting practices, target market, etc.
- The industry data available may not be elaborate/not in line with your definition of a smoker /non-smoker, and hence may to suit your purpose. Then adjustments needs to be made
- In case there is no industry data, then will have to resort to the national statistics; care needs to be taken to adjust it for the required purpose
- Industry data would always be closer an estimate compared to national statistics; as the relevance of the data/ investigation is closer to our purpose
- Also it is the insured population statistics compared to a national statistics
- Both industry and national statistics may be outdated, as it takes time to collect information, collate and prepare the report and hence data may need to be allowed for any observed change ( for eg., availability of new treatments leading to increase in longevity, new diseases associated with smoking etc.)

- You may also refer to some research reports prepared by authentic institutions/ organisations. Again the purpose with which the report is collated may be different from the purpose for which you are using. Suitable adjustments should be made.

- Reinsurer may provide useful information either for your country or some similar country. Suitable adjustments need to be made to make it more reflect the target market, race/genetic factors etc.

**[5]**
**[13 Marks]**

**Solution 7:**

**(i)** Reasons for maintaining solvency capital:

- It serves as additional protection to the customer over and above that provided on individual risk basis
- The objective is to reduce the likelihood of the insurer becoming insolvent in reasonably foreseeable circumstances
- Helps prevent systematic collapse of the insurance/ financial industry
- It helps increase the confidence of the industry and in the industry
- it helps getting early warnings; if the insurer is unable to meet the solvency capital requirements, it will trigger regulators intervention like….

- regulator may impose
  - more strenuous reporting requirements
  - insurer will need to submit a recovery plan
  - will ask for a review to the management practices. **[4]**

**(ii)**
Internal sources of capital management could be:

- funds could be merged
  ... where some solvency margin requirements could be a fixed amount on per fund basis or
  ... have a fixed minimum per fund
- assets could be changed to reduce level of ALM mis-mactch and reduce inadmissible assets
- Prudence in valuation basis could be weakened if allowed as per regulatory/professional guidelines.
- capital could be retained, by not paying/reducing dividends to the shareholders

**[4]**

**(iii)**
Factors that would influence the choice:
Funds could be merged

- if there is a benefit in reducing solvency margin due to fixed amount requirements on per fund basis
- what are the practical issues in merging the funds
- cost implications

- Regulatory issues
- Customer/shareholder communications
- Tax issues

Assets could be changed

- Makes sense if you have inadmissible assets which can be exchanged for admissible assets
- It may not be easy to dispose inadmissible assets, say work of art
- Even is the value of the assets exchanged are same, there would some cost of the transactions, tax issues which needs to be factored in
- Assets and liabilities cash flow/duration matching could be done to reduce mis-match reserve requirements

Valuation assumption to be weakened

- Will have to follow the regulations and any professional guidance offered in this matter
- Arbitrary changes in bases may not be encouraged
- May have tax implications

Not distributing dividends to shareholders

- How will the share price get affected
- How will the rating agencies view it
- Shareholder's may prefer some stability in dividend distribution. **[5]**

**[13 Marks]**

**Solution 8:**

**(i)** stakeholders

- Employer
- Trustees
- Members (Current, deferred, prospective and pensioners)
- Dependants of members
- Regulator
- Government
- Actuaries
- Auditors
- Investment managers

**[3]**

**(ii)** Demographic assumptions include

- Before retirement mortality of members - Current, deferred, prospective and pensioners

- Post retirement mortality of members
- Mortality rates of dependants
- withdrawal rates
- ill health retirement rates
- Retirement rates
- New entrant rates
- Proportion married
- Average age of spouses
- Salary scale (promotional increases)

**[4]**

**(iii)** General :

- Other employees will include administrative staff, marketing employees, workers in the factories etc.
- The scheme may not have the past experience in respect of the other employees as they have been included in the scheme recently.

To value the scheme, the scheme can be split into two.

- ➢ The management class and
- ➢ Administrative staff /marketing staff
- ➢ Factory workers

- The past experience of the management class can be used with suitable changes for the future experience and valued separately.

- The past experience in respect of other employees split by blue collared and while collared for each of the parameters can be obtained from the company and used, if it has been recorded properly
- Otherwise, if the company has any insurance scheme for its employees the same experience can be used.
- As the past experience in respect of employees other than management cadre is being assumed for the first time, more margins can be allowed for prudence.

Mortality:

- The data available with the company may not be large enough to arrive at the mortality rates for each age group; hence adjustments to the standard mortality table can be made and used.
- The mortality experience of the blue collared employees (both before retirement and after retirement] may not be very different than management class as they may not be subject to work related hazards etc. though it could be relatively poor hence suitable adjustments need to be made
- Workers may have relatively heavier mortality experience than others due to poor living conditions, affordability to quality health care etc.

- Workers: it has to be seen if any occupational hazard is there- difficult working conditions, exposure to harmful items, chemicals, working with huge machinery.
- Importance of safety at factory site might be an important driver; past accidents at site will be a useful data.
- Heavier mortality may be assumed for workers allowing for suitable margin for prudence.
- But the benefits for workers might be lower and hence overall weightage may be more critical.

Withdrawal rates:

- The past experience of the company can be used for setting the assumptions for workers/other employees.
- The withdrawal rates of management class are likely to be different compared to workers as more job opportunities may be available for management class employees.
- The withdrawal assumption should be set taking into account the withdrawal benefits payable and after allowing for margins in assumptions for prudence.
- While setting the assumptions, whether the company plans for any Voluntary retirement schemes need to be ascertained. If so, the revised benefits, expected take up rate should also be ascertained and valued accordingly.

Retirement rates/ill health

- The retirement ages of the workers/other employees and management class may be different.
- Retirement due to ill health may be more common with workers.
- If ill health terms are more beneficial than retirement terms, assumptions should be made accordingly.
- More so, now that the workers are eligible for pension, workers who are suffering from ill health and not able to work may opt for pension, if the terms are better.

- When a scheme is introduced for the first time, there will be a backlog of employees who will want to take the benefit and leave. That could lead to a one-time increase in withdrawal, which need not be taken for future assumptions
- In such cases, the past data may not be entirely reliable and allowance should be made for the same.

New entrant assumptions:

- The plans of the company in respect of recruitment of employees under management cadre, workers cadre and other employees need to be obtained and allowed for.
- It could be a one-off event or happening at regular intervals.

Salary scale progression:

- The rates may be different for management cadre, workers cadre and other employees.
- The details may be obtained from the company and valued accordingly.
- The plans of the company regarding any likely wage revision can be obtained and allowed for while valuing.
- It will also depend on the type of industry and whether the company is making a profit.

Marital Status:

- If the data is available with the company, proportion can be arrived at accordingly.
- Average age difference between the members and spouse can be assumed for arriving at spouse ages.

**[11]**
**[18 Marks]**

**Solution 9:**

**(i)**

- The methodology of allocation of indirect expenses/overheads/one off expenses to various activities acquisition/maintenance/claims will impact valuation expense assumptions. The expenses have to be allocated to the various activities to understand the impact of increase on expenses on the various activities.

- The assumptions relevant for supervisory valuation will relate to maintenance expenses and claims expense only

**Investigate the likely reasons for increase in expenses**

- It should be investigated whether the expense increase is due to one-off expense or likely to continue in future.
  For eg.,
- It could be due to development costs relating to any line of business/product/acquisition of new business channel. It may not impact valuation expense assumption but depends on how recovery of expenses planned.
- Increase could be due regulatory penalties. If so, it may not be occurring every year and may not affect the valuation assumption for expenses.
- Increase could be due to arrears of wage revisions payment and hence the expected yearly increase in salaries based on current levels and expected future increases should be allowed for in the valuation assumptions.
- It could be due to one off brand building exercise which need not impact valuation expense assumption.

- It could be due to one-off IT expenses in which case it may not impact valuation expense assumption.
- It could be due to more new business sold during the period and hence more expenses relating to commission and acquisition expenses. As it relates to new business, it may not impact the valuation assumption.
- If it is not a one off expense/and is not related to new business acquisition, then understand reasons for the increase, investigate is it due to -

  - Change in business mix requiring higher maintenance expenses
  - Change in Distribution channel mix which has led to change in policy servicing and claims activity
  - Change in policy servicing requirements (for eg. Significant surrenders, early claims, claims underwriting policy etc.) which has led to this increase
- If the expense trend is likely to continue then this should be allowed for in valuation.

**<u>Impact on valuation assumption for expenses</u>**

- For the increase in absolute maintenance expenses, if there is a corresponding increase in policies and premium then the valuation assumptions may be not be impacted.
- If this increase in maintenance expenses or portion of the increase were anticipated and allowed for in the earlier valuations itself then it may not lead to a corresponding increase in expense assumption for the current year.
- This is a supervisory valuation and there could be guidance given by the regulator and this needs to be followed while setting the assumptions.
- Guidance notes by profession also might be available.
- The assumptions for supervisory valuation are generally prudent.

**[7]**

**(ii)**

Possible courses of action: Look at ways of reducing the level of absolute expenses:

Reducing expenses overall

- Strict expense budgeting and implementation.

- Effective use of technology
- Keep salary increases to minimum levels
- If employees defined benefit pension schemes are funded, to keep contributions to the minimal level till situation is brought under control
- To reduce spending on new projects/development of new products till the situation is manageable.
- Close unprofitable branches.
- Shift back offices to cheaper locations.
- Look at ways of deploying employees of redundant services such as closed branches or new projects stalled for other functions.

- Close down channels which are expensive and not adequately productive
- Change compensation package to make it more variable, make external contract pay-outs variable
- Reduce branding/marketing expense
- Renegotiate office rentals/leases
- Renegotiate third party vendor contracts

Cost effective sales:

- To sell policies with lower initial expenses. For example, through cost effective distribution channels.
- Try to sell policies with higher ticket size and hence higher contribution to expenses.
- Sell more single premium policies if it leads to reduction in costs. Lower servicing costs.
- Give profitability targets to channels, branches, etc. Instead of only sales targets

Improving persistency

- Try reducing lapses/withdrawals so that per policy expense will reduce.
- Improve renewals. It might be cheaper to retain a policy than procure a new policy

Reviewability of premiums/charges

- To increase expense charges in case of unit linked or review premiums if possible so that there is more contribution towards expenses.

Accounting

- If the sudden increase in expense is due to acquisition of a company or business; see if you can amortise this expense instead of hitting in your balance sheet in one year itself.

Regulatory compliance

- If the increase in expense is due to a regulatory penalty, etc then make sure good processes and governance in place, such that it is not repeated
- If it is threatening the regulatory solvency; the regulator will also be interested in your plan of action. Discuss the plan with them and get their concurrence

**[8]**

**(iii)** Possible courses of action to improve solvency position

- Weakening of basis if permitted by regulator: Reduce excessive margins in other parameters such as Interest, mortality, withdrawals etc.
- Reduce global provisions if already set at higher than that required by regulator in respect of Mismatch reserves, resilience reserves etc.
- If reinsurance has not been used utilised fully for regulatory purposes, it should be used.
- Deferral of surplus distribution to policyholders/shareholders. This will depend on PRE, competition etc.

- Change in valuation basis if beneficial: For example, expense per policy can be changed as expense per 1000 benefit or as a % premium if it leads to lower liability, but this would need to be justified

**[4]**

**[19 Marks]**

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