Institute of Actuaries of India

Subject CA1-II – Actuarial Risk Management

March 2017 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.

Solution 1:

i) Indemnity is compensation /reimbursement for a loss. The idea is that insured is restored to the same financial position as before the loss occurred

- products are designed to meet customer needs
- In case of certain contingencies indemnity would be the need of customer, for eg, reimbursement of hospitalisation expenses
- Since the actual expenses that a customer can incur at time of policy purchase is unknown, the customer's need would be that the policy indemnify him for the actual expenses incurred
- Certain perils like, disability, critical illness, etc
- where the actual loss to the customer could be more than hospitalization expenses for eg, temporary/permanent loss of pay, inability to pay back loans etc.
  … customer's need would be benefit of pre-specified amount linked to his loan liability, etc

(3)

b) In case of indemnity type product since benefit is linked to actual expenses incurred by policyholder, risk of over insurance has limited relevance.

In case of fixed benefit type product, since customer may have choice over level of benefit, it is necessary to ensure benefits are reasonable relative to the financial loss from the insured event. Hence, it may be necessary to seek details of income, sources of income, any prior insurance of similar type with any other insurer , loan liability etc

(2)

[5 Marks]

Solution 2:

- It is true some of the risks are passed on to the employee incase of choosing a defined contribution scheme.
- Some of these key risks passed on are:
  - Investment return is lower than expected
  - Longevity improves before retirement this may be reflected in the annuity purchased at retirement
  - Expenses higher than expected if it is paid by the employee
- While transferring these risks, both the downside as well as the upside is passed on to the member.
  … The employer/ sponsor will not get any benefit of the upside
- Even in a defined contribution scheme, there is some risks still borne by the employer
  … Though the contribution rate is fixed in a DC scheme, the total cost is not known because it depends on:
  - The number of employees in the scheme at any point in time
  - Level of salary increases over time
  - In some cases, the contribution rate may vary with age or service, then it is dependent on the mix of employees

  - … also sometimes the employer agrees to match the contribution made by the employee, here again the cost of the contribution is not certain
- The contributions may have to be paid at inopportune time (employer having some cash constraint)
- In case, the resultant benefit is poor, the employer may be under pressure to make good the benefit/increase the contribution in future
- Can lead to bad publicity / reputational risk
- To support the above, there may be a minimum DB underpin to the benefit
  … in which case the full risk is not passed on to the employee

  There are general risks that the employer can't eliminate
-
  - Fraud or misappropriation of funds
  - Error in administration (like wrong allocation of contribution; not deducting contribution or deducting higher contribution from salary
  - Any advice provided might be incorrect, leading to repercussion for the employer
  - Inappropriate decision made by the trustees, leading to repercussion for the employer
  - Any administrative cost (like cost of compliance)
  - It may be harder to attract and retain good staff
  - There might be breaches in regulationsleading to fines or loss of tax status
  - There might be changes in regulation or tax status which will affect the cost of the scheme

[8 Marks]

Solution 3:

i) The main users in this case would be:
  - Actuaries
  - Accountants
  - Underwriters
  - Operation staff
  - Management
  - Marketing
  - IT
  - Claims team
  - Data analytics team

(3)

ii)

- first decision to make is whether the existing loan management system can be upgraded to cater to new needs or a separate Policy administration system needs to be purchased
- If a new system is purchased how can same be integrated with existing system to ensure seamless integration of data

- The system should be user friendly for all the users
- Single system for all purpose (for e.g. policy administration, claims, underwriting, etc)
- It should enable good data quality important
    - Alignment of theproposal form and the data entry screen , can ensure there is less error while typing the data
    - Data fields should be built with validations, so that wrong data can't be entered in the first place
    - The system should have various checks and controls to make sure the data is complete and correct as far as possible

      For example:
        - ✓ Certain data fields can't be blank
        - ✓ All date fields should have sensible dates
        - ✓ Some fields can't be zero or negative (like premium or Sum insured)
        - ✓ Some consistency checks (are premium and Sum insured consistent)

- Rating factors
    - The system should have provision to store more data fields than that may be currently required for the loan product
    - … for example, age/sex of driver, usage, experience of driver, etc
- System should be able to handle large volumes of data; both from holding and processing perspective
- System should be scalable & flexible to accommodate future enhancements:
    - if want to sell other products (like home product) to the existing clients
    - Enhance the rating structure of the current product as required

- System Security & data integrity issues to be addresses
    - Access levels
    - Password and security levels
    - Regular back ups
    - A system of version control should be in place
- The system should be support various forms for report extraction
- It should be able to incorporate requirements required for reinsurance arrangements as well
- Good management control system should be in place to ensure good data on an on-going basis

(5)

iii)

- Data currently company has relates to the loan product.
- Utmost existing data can assist company to know most popular make/models, ….socio economic profile of customer
- This can be used to understand target market and customer preferences.
- Decide areas where it needs to be competitive to enhance new business

- Expenses relating to servicing of loan customers, which could help assist in setting expense levels for the new product

(3)

[11 Marks]

Solution 4:

i) Critical illness Rate

This is clearly a very important assumption in this product
.. especially in the early durations, when the minimum guarantee is likely to bite
The CI rates chosen should reflect the future CI experience expected of the target customers
The company has no data to base this assumption on
Need to check if any reliable industry data is available of such.
… even if there it might be difficult to lay your hands on competitor data
… and how comparable would it be to the present product needs to be checked

Does Reinsurer have any useful data
.. not sure from this market, depends on if CI is a new risk in the market
… else in some overseas market, which needs to be adjusted for this market

From where ever you get the data adjustments would need to be made for differences such as :

- CI definitions, level of severity of disease covered in the contract
- Policy wordings
- underwriting and claims processing practices
- differences in lifestyle, diet, health care environment in the different target markets
- legal standings of different markets

allowance has to be made also for changes in future morbidity experience/future change in definition of CI:

- improving diagnostic techniques, making early detection of CI
- medical advancement and hence cure for certain CIs

you may use national statistics
… but this may be for the overall population and not of the insured lives
… CI definitions could also be different

Whatever data is used, there is going to be limited or no data for certain illness or at extreme ages

Overall it will be difficult to get a fix on the various CI incidence rates

Therefore there will be a risk CI rates are higher than expected, so that:

- The fund value will have had less timeto accumulate above the guaranteed amount
- The company will not have recouped its initial expenses

However this will not be too problematic if the unit linked natureof the contract permits reviewable charges

Once the company decided a suitable best estimate of the future experience a margin will need to be added. This should be reasonably big because of the uncertainty
… but not huge because of competitiveness and the ability to vary the rates

However competitors are also likely to include margins since this is a new product for all, so they have the same problems

(5)

ii) Expenses
Need to set charges by estimating the expected expenses to be incurred in writing and administering the product
Good starting point would be to check the recent expense investigation results of some related product
.. you may need to adjust for any aspects which might be significantly different
For example underwriting and claims administration (would be different for CI products)
Allowance to be built for a part of the fixed expenses
… and any cost of developing this product
Industry data would be of no use here.
… availability also is doubtful
Use of expense model – given the expected new business over the next few years (say 5 yrs) and expected overheads to cover over that period, what will a reasonable per policy expense assumption be
Commission – will have to be set in line with the market
These should give you expenses as a percentage of premium
.. proportion of fund (for Fund management)
… fixed per policy loading

Also need assumption for expense inflation
What is the current and expected inflation.
… see from financial data available in the market
… yield difference between fixed and index linked bonds can be a good estimate for expected inflation in future

If future charges can be adjusted for inflation under the product, then it may not be critical to get the assumptions very accurately
Initial expenses will be critical and significant assumption
.. also because the initial underwriting expenses would be higher for a CI cover
Regular expenses may be less important, fund management expenses may be well covered within the FMC charged
Claims expenses may be crucial, due to CI claims needing more investigation than other types of claims
… there will be a need to validate / investigate CI claims.

(5)

iii) Interest rate
This is not that important as a component of the pricing basis…

… because this is mainly a unit linked product …
… and the investment risk will be borne by the policyholders

However, the cost of the guaranteed CI benefit will be met by the company. Therefore there is the risk of poor investment returns reducing the value of the fund below the guaranteed amount.

There will also be some investment risk to the company from the fund management charges in the contract
…. This is because if the value of the investments and hence the value of units fall, so will the amount of the fund management charge and

hence future profits and expense recoveries as well
There may be many fund choices, based on various asset mix and varying levels of fund management charges. Hence some assumptions needs to made as regards expected future asset mix, resultant fund growth and fund management charges

(3)
[13 Marks]

Solution 5:

i)

- Analyse whether there would be sufficient demand for such a service,
- whether public transport system is available in the city or any new system is emerging like metro,
- what is the level of smart phone penetration, mobile internet penetration, speed and connectivity

Initial outlay

- Capital expenditure on buying a fleet of cabs-
- Infrastructure in terms of back and front office-
- Recruitment of drivers hence hiring costs
- Obtaining necessary government approvals
- Advertisements
- Market research
  IT resources to be purchased- hardware and initial software purchase and licensing
- Hiring charges for recruiting IT professionals for developmentand maintenance of mobile application
- Purchase of data –for eg., potential customers details,
- Tie up with service providers like those providing on line traffic maps
- Developing system for various payment options

Regular costs:

- Maintenance of cars,
- drivers and employees salaries,
- system upgrades, software licenses etc. **(5)**

(ii)

Risks	Mitigation
Product is not launched properly	Marketing research before launch, Advertisement targeting preferred markets, Initial freebies /offers to public to try the service, launch after proper market research, Introduce options for corporate booking etc.
Costs of set up higher than expected	Proper analysis of costs before launch, keep sufficient margins while pricing, look at cheaper options – for eg. Recruiting drivers with cars and compensating appropriately
Poor service and hence bad publicity leading to reducing demand	Poor service could mean Not getting cabs on time – • ensure there is real time sync in mapping, provide regular updates to customers • Maintain dynamic customer service to address issues/refunds etc. Poor service by drivers – • system where customers can give feedback about drivers behavior, drivers salaries linked to good service, regular training of staff and drivers, counselling etc. • Cab application should be interactive to enable customers to give feedback without much time wastage. • Effective Customer grievance addressal
Competitors products attractive leading to lower bookings/ lower profits	Ensure continuous monitoring of competitor prices, strategy, TAT, etc. Keep introducing innovative ideas – different types of cabs from normal to luxury depending on needs, incentivize customers not travelling during peak hours
Poaching of staff, good drivers	Incentivize good drivers Develop strong second lines to ensure no disruption in service due to staff leaving Competitive wages, perks to staff/drivers
Physical damage to cars	Property Insurance
Death/Disability of drivers	Life/Disability insurance
Third Party property damage/Damage to Life	Liability insurance cover

(10)
[15 Marks]

Solution 6:

i)

- The valuation assumptions will depend on the expected future experience with margins for prudence.
- The existing regulations and guidance notes issued by the professional body may prescribe how the valuation assumptions are to be arrived at.

Mortality:

- As the cure was invented only recently, analysis of recent mortality experience of the annuitants may not reflect immediate improvements in mortality.
- It may take some more years to assess the actual impact.
- It again depends on number of annuitants currently suffering from the disease.
- If the mortality assumptions are already prudent and hence lighter, the company may decide to continue with the same.
- Alternatively, the company may revise the mortality assumptions to reflect the likely changes in experience.
- It should also be ensured that the assumptions are not subject to arbitrary changes.

Expenses:

- Expenses should be projected into future taking into account the likely reduction in maintenance expenses to arrive at the likely expense per policy.
- As people are likely to survive longer, in order to manage the longevity risk, more individuals may purchase annuities in future thereby increasing new business costs. This could also lead to reduction in fixed expense per policy maintenance expense due to expense overheads being spread over more policies.
- The expense assumption must include margins for prudence.

Investment return:

Depends on local regulations as regards statutory valuation.

- Since annuity is a single premium product, valuation interest rate should be based on investment yields on assets locked into. Hence if yields on assets purchased in the annuity portfolio in the last year have increased then same will be reflected in portfolio yields locked into, and hence valuation interest rate.
- Allowance for prudence as required under regulation.

(5)

ii)

Surplus or deficit will arise when the actual experience differs from the assumptions made.

Mortality:

- Surplus/deficit could arise based on actual experience vs that assumed in statutory valuation.

- The invention of drug to cure the disease could lead to improvements in mortality for people above age of 50 but the drug was invented last year and it could take some time for it to be available for sale to general public.
- Hence it is unlikely that there would have been fewer deaths than expected in current year due to the new drug but
- If mortality is expected to improve the mortality then liability could increase which could lead to fall in surplus arising due to need for strengthening of longevity assumption (basis change)

Expenses:

- Reduction in actual expenses compared to last year and improvement in operation efficiencies, will lead to expense surplus.
- Future maintenance expense assumption could be reduced leading to fall in liability(basis change) and hence increase in surplus arising
- If this reduction in expenses was anticipated before last year valuation and the expense valuation assumptions were already reduced then surplus will not arise in the current year because of this factor.

Investment return:

- The impact of increase in interest rate will depend on the level of asset liability matching and method of valuation of assets and liabilities
- If assets and liabilities are marked to market, If duration of assets is less than liability (which is normally case with annuity) then fall in interest rate will lead fall in value of assets being lower than fall in value of liabilities. Surplus will increase. The reverse will hold true if duration of assets >duration of liabilities.
- If assets and liabilities are at Book value, increase in yield on government securities will only affect the new investments made in the current year.
- New investments will pertain to the new business premium income of current year less expenses and any reinvestments made.
- It will not affect locked in yield on existing investments.
- The surplus will increase to the extent of new investments only.

(5)

iii)

The other areas of actuarial work:

Re pricing of immediate annuities:

- The company could reprice the immediate annuities taking into account the above factors to make the product more attractive.

Re pricing of other types of products:

- The other products like without profit whole life, without profit term assurance etc. may also need to be repriced to allow for the improvements in mortality and increase in yield.

- With profit types of products may not be repriced as any surplus arising may be paid in the form of bonus to policyholders.

Provisioning on realistic basis:

- The revised assumptions may be used to prepare realistic provisions for reporting to the management or reporting in the accounts.

Profitability and capital requirements:

- The profitability of the existing business and return on capital need to be assessed with revised assumptions.
- Future solvency and capital requirements need to be assessed.

Asset liability management:

The revised assumptions can be used for liability projections and arriving at the appropriate investment strategy.

(5)
[15 Marks]

Solution 7:

Risk Appetite

- Option1 - provides a defined benefit, therefore…
  …under option1, both upside and downside risk lies with the scheme
- For example, if the member's actual salary growth is greater than expected then the actual cost of the member's benefit will exceed the value of the pensions savings transferred in. Therefore the risk appetite of the sponsor is critical

- Option2: Under option2, both upside and downside risk lies with the member
  For example, if the investment returns are good (poor) then the pension will be high (low)
- If the annuity terms are favourable (unfavourable) then the pension will be high (low), since longevity risk lies with the member.

- Under option2, there may be different investment fund options, which might provide variety for members with different risk appetite

Interests and needs of the members

- Consider the financial sophistication of the membership
- It is easier for the member to understand option1 since all the benefits will be in one form
- It will be difficult for them to judge if value for money was given, whether the additional benefit added to the existing DB scheme is fair
- Also under option 1, retirement planning is easy as all the benefits are in DB format and the member will know what he is getting

- Option 2 is more transparent, although member may find investment choices difficult to understand if such choices are offered
- Also difficult to follow two benefits from two different schemes for retirement, may confuse the member as to how much is he expecting at retirement

Contract design factors

- The chosen approach must comply with regulation

… and with the scheme rules

- What are the competitors doing – it might be sensible not to deviate too far from their practices
- It will also be important to consider the approach adopted in the past by this scheme. The trustees may not want to change the approach
- The likely take up rate for the option should be considered, for example if few members are likely to exercise the option then it may not be worth setting up a separate benefit section as required under option 2.

Subsequent transfer out

- It will be necessary to consider the approach to follow if the member subsequently wants to transfer savings out again prior to retirement
- Option 2 is easy to deal with, as the member can just be allowed to take the fund value at the time of exit
- Option1 is more complex. A calculation of the value of member's benefits at that time would need to be determined and tested for reasonableness
- … for example this value could be compared with the pensions savings transferred in (perhaps rolled up at a certain rate of interest)

Administration system

- Option1 requires initial calculations to determine the benefits that should be awarded
- Once the calculation is done the administration is relatively simple, since all the benefits will be in the same form (final salary)
- Option 2 requires no initial calculations, but there will be administrative complications in setting up and running a separate accumulation account for each member transferring-in.
- If various investment options are offered, this will further complicate the administration and increase the cost also

[16 Marks]

Solution 8:

i) Factors to take into account while doing professional job:

- Act in a professional manner with integrity and detachment from their own personal circumstances.
- Develop a direct, personal and trusting relationship with the client in order to advise on the most suitable solution for that particular client.
- Required to take decisions and take personal responsibility for those decisions.
- Recognise that others have valid views and it may differ from his/her own.

- Attain and maintain competence in a given field
- Be reliable, deliver good quality work in a given timeframe.
- If it is clear that it is difficult to reconcile quality, detail and timeliness, discuss with client at the earliest.
- Communicate clearly
- Recognise exactly who the client is and what their needs are
- Recognise and seek to avoid conflict of interest

(5)

ii)

Current and prospective policyholders: they want the investment to be value for money and hence discontinuance terms to be attractive and give them flexibility and liquidity.

Life Insurance company shareholders: want to offer attractive products and increase sales/popularity and increase profitability/get stable profits.

Life insurance company Distribution channels: Attractive products will make the selling process easier and help in increasing sales thereby increasing distribution channels income.

Regulators: They have policyholders interest in mind and want to ensure that policyholder's benefits should be secured. At the same time, they do not want the discontinuance terms to be too aggressive threatening the solvency of the company. It could lead to aggressive action by competitors resulting in risk for whole industry.

Competitors: It could affect competitors resulting in them also to offer attractive terms/change discontinuance terms which may or may not be affordable. It could affect their competitive position.

(4)

iii)

- It is natural for policyholder to compare with premium paid in the initial years.
- The Marketing manager is trying to make the product more attractive by offering better surrender terms in the initial years, compared to the current terms
- This could bring more new business, provided it is very attractive compared to competition

… more business also means expense efficiency

- It may also lead to higher surrenders in the initial years

… by when the company would not have recovered all their initial expenses/

… it may make the product less profitable for the company

- While evaluating the proposal let's look at two aspects
    - Do we want to offer surrender valueat the end of first year itself
        - If no surrender value was paid in the first year earlier, it could lead to change in surrender philosophy.
    - Can we afford 70% of the premium paid as the Surrender Value
    - Would it be appropriate to use a more graded scale like a lower percentage in first increasing to 70% at the end of 3 years.

But even then it need not be affordable

- Affordability is assessed using asset shares. Generally asset share is the starting point for calculating surrender value.
- In the initial years the asset share will be negative for regular premium contracts due to high initial expenses such as commission, policy issue costs, underwriting etc.
- Company would also be interested in making some profits on such policies surrendering in the initial years; at 70% SV, will the company be able to recover all its initial expenses and can it make some reasonable profits
- To assess whether this proposal is viable, likely asset share at end of first three years needs to be compared with 70% of premiums received.
- Check will need to be made for various model points, taking various age, term, premium bands;
- The proposed SV may be onerous incase of very long term contracts or smaller premium size policies or for higher age policyholders
- Sensitivity testing of these surrender value with pessimistic scenarios i.e, higher initial expenses and/or adverse investment scenarios
- Surrender factor in the subsequent years should also smoothly progress

…sudden hike in first 3 years surrender rate may lead to hike to subsequent years surrender factors too, to bring them in line with the proposed surrender scale for first 3 years

- The effect of selective withdrawal on remaining contracts needs to be considered.
- The company on the other hand might be working to improve its customer retention level; then this move will be against that philosophy
- Offering high surrender value could increase the reserving requirement and hence cost of capital.
- Is it consistent with other similar products (with profit endowment)
- There can be lot of discontentment among existing policyholders of other products if similar scale not offered to all. It should be seen what is being offered by competitors.

…And how far has it impacted their new business

… and profitability of the portfolio

- You don't want to be changing the surrender value factors too frequently
- How does it impact the system administration

… hopefully it is not very challenging to incorporate this feature

- If these leads to losses, proportion of people like to surrender in the initial years needs to be arrived at.
- The likely losses/reduced profit needs to be compared with the benefit due to higher sales.

(8)
[17 Marks]

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