Institute of Actuaries of India

Subject CA1 – Paper II
Core Applications Concepts

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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.

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Chairperson, Examination Committee

Q.1) Projects need:

- a clear definition of the aim of the project which reflects the needs of the customer
- full planning (elaborated:)
  - to move along at the appropriate pace so that the right things are done at the right time
  - care in managing different strands of the project to ensure that there are no unnecessary delays in one part of the project which depends on the outcome of another (critical path analysis)
- thorough risk analysis
- monitoring of development
- measurement of performance and quality standards
- thorough testing at all stages
- stable but challenging relationships with suppliers of external components of the project
- a supportive environment
  - excellent communications between those involved
  - positive conflict management, which uses conflict as a source of ideas and a tool for development
- a schedule of what needs to be considered at each milestone review point.
- strong leadership team

The key factors in managing a successful project include:

• a clear definition of the project, including objectives, roles and responsibilities

- formation of a team including all stakeholders
- including legal, accounting, actuarial prod dev, actuarial finance, marketing, sales, IT, underwriting
- clarity on the product structure and benefits being offered
- clearly defined roles and responsibilities

• planning

- establish timelines
  - estimated work flows times for designing benefits,
  - building product structure in various systems (IT, accounting, actuarial),
  - pricing product
- key dates / milestones
  - filing for regulatory clearance;
  - launch date

• risk analysis

- based on product design / benefit structure – mortality, interest,
- ensuring benefits aren't priced too cheaply (loss making)
- or too expensive (not profitable)
- benefit actually wanted by the market
- new business volumes sufficient to cover overhead expense allocation

• regular monitoring of progress against objectives

- regular investigations to check assumptions used are appropriate
  - expense, mortality, investment, persistency
- sales volumes to see if market accepts
  - product structure
  - product pricing
- where assumptions not validated feedback into re-pricing

• excellent communication and support between all parties

- regular meetings
- keeping minutes of meetings
- good written documentation

• a strong leadership team

- sponsor/owner a senior member of the company
- political backing for the project with associated budget **[10]**

Q.2)

i) **Assumptions:**

Investment rates
Reinvestment rates
Mortality, disability, retirement due to ill-health
Salary increase rates
Administration expenses
Investment expenses
Tax
Normal retirement age
Margins for prudence (internal or statutory).

ii) a) Annuitant members will want the employer to increase the funding level.
They will want this to reduce the likelihood of benefits in the scheme not being paid.
The employer will want to lower the funding level.
He will want this to reduce the negative cashflow on his business and so as to unnecessarily tie up capital.

b) Annuitant members will want a strong basis

- with lower mortality assumed for annuitants
- higher mortality rates for active members if the benefits of death are larger than the value of the annuity
- or lower mortality for active members if the benefits paid on death are lower than the value of the annuity
- higher incidence rates for early retirement due to ill health
- lower future investment returns
- higher salary increase rates
- higher expenses
- higher tax within the fund

iii) Trustees are required to look after the interests of the members of the scheme.

- A weak basis may get them into trouble with the regulator for the statutory valuation
- Uncertainty about ability of the fund to pay future benefits for Active members, future employees and annuitant members.
- Positive impact for the employer means the employer unlikely to terminate the scheme or be closed down.
- But employer pays salaries or active members -> beneficial for active member's current income.
- Lower funding basis may catch up with the employer later leaving a funding deficit that needs to be made up in future years. Will the employer be able to make those higher future payments?

Satisfy the auditors that the basis is appropriate and meets all necessary, relevant standards

[9]

Q.3)

a) New business strain arises when the premium(s) paid at the start of a contract, less the initial expenses including commission payments, is not sufficient to cover the reserve that the company needs to set up at that point.

b) The moral hazard is the risk that an insured may attempt to take an unfair advantage of the insurer, for example by suppressing information relevant to the assessment of risk or by submitting a false claim.
Anti-selection is also taking advantage of particular aspects of a insurance contract, but within the terms offered by the insurer.

c) The sources of business risks are

- Claims
    - Mortality
    - longevity (incl medical advances)

  - morbidity
  - aggregations and concentration of risk
- withdrawal
  - early withdrawal results in not recovering initial expense
- mix of new business
  - fixed expense allocation between product types and premium size
- volumes of new business
  - insufficient to cover fixed expenses (if too low)
  - insufficient for direct agents to earn a living -> drop in future sales force
  - requires too much capital (if too high)
- options and guarantees offered
  - charging may make product seem expensive to clients -> affecting new business volumes
  - holding additional capital -> leading to solvency issues
- reinsurance
  - not appreciating level of risk -> underinsuring the business
  - availability and cost of desired reinsurance (eg stop loss)
  - reinsurance is poor value for money
- operational risks
  - underwriting standards
  - claims higher than expected

d) Risk rejection and mitigation

- claims risks
  - quota share or risk xl reinsurance
  - continuous underwriting of disability patients
  - catastrophe reinsurance for agg. and conc. of risk
- withdrawal
  - ensure appropriate surrender penalties to cover lost initial expenses
  - clawback commission from intermediaries for early withdrawal
- mix of new business
  - allocate fixed expenses evenly across product classes
  - allocate fixed expenses evenly across premium sizes
- volumes of new business
  - Financial reinsurance to cover volumes too high
- Operational risks
  - Ensure appropriate underwriting standards at time of product development
- Ensure that inappropriate risks are rejected at application stage
  - And effective testing of underwriting standards on an ongoing basis
  - claims stage underwriting

[17]

Q.4) (1) A provider should select investments that are appropriate to the:

- nature, term, currency of the liabilities,
- he provider's appetite for risk.

(2) Subject to (1) the investments should also be selected so as to maximise the overall return on the assets, where overall return includes both income and capital.

The investment strategy needs to cover the investment of assets for the products in question as well as the free assets/surplus backing the business.

Invest all assets in the currency of the contracts

Endowment business

- Benefits are guaranteed in money terms
- so are best backed by fixed interest assets
- premiums are negative guaranteed in money terms
- problems finding long enough dated assets
- matching against actual mortality is impossible

Unit Linked business

- The benefits are guaranteed to the extent that their value can be determined at any time in accordance with a definite formula based on the value of a specified fund of assets or index.
- The provider can avoid any investment matching problems by investing in the same assets as used to determine the benefits.
- Where the benefits are linked to an index, replicating a market index may involve holding a large number of small holdings and thus be too costly.
- Companies might choose to use collective investment schemes or a derivative strategy to achieve this.

Expenses

- are index linked to inflation
- so should be backed by index linked bonds
- or equities when linked bonds not available

With Profit Annuity

- Policyholders will have expectations based on sales literature and past practice of the company
- The future investment strategy of the company must take this into account.
- benefits that are already guaranteed will be backed with a fixed interest portfolio
- future discretionary bonuses can be use equity or property to provide long-term
- the portfolio is closed so there will be no new money flowing into the portfolio
- and money flowing out of the portfolio on a regular basis
- requiring liquidity in the assets

The company will be able to mismatch subject to an appropriate level of insolvency risk.
This will depend on the company's appetite for risk and level of free assets.
The long term negative guaranteed benefit cashflows (in the form of premiums) from the endowment can be offset against the guaranteed payout benefits from the annuity
Capital backing the business will need to be invested subject to regulatory constraints
The other free assets of the company will also need to be invested
The investment strategy will be subject to shareholder's risk appetite and long-term objectives

[16]

Q.5)

a) Bookwork points:

- consider the use to which the assumptions will be put.
- take particular care over the choice of the assumptions that will have the most financial significance
- achieve consistency between the various assumptions
- consider any legislative or regulatory constraints
- consider the needs of the client.

Also

- discontinuance rates must be fair to the exiting member
- fair to remaining members

fair to the provider of the benefits

b) Analysis points

- basis used should be a realistic basis
- too strong a basis would provide the exiting member with less money than he is due
- too weak a basis would adversely affect the remaining members
- discontinuance benefits relates to the size and type of benefit
- type of benefit most likely to be a lumpsum which can be transferred into another benefit scheme
- or as a continuation of benefits within the scheme
- the decision on the form of benefits will depend on the existing rules of the scheme

- and on the needs of the client as specified by the HR strategy
- and may need to be enhanced to attract prospective employees
- consistency will be needed between assumed salary inflation and assumed inflation
- assumed investment return and assumed inflation
- statutory minimum benefits

[9]

Q.6)

a) *Book work*

A provider will want to analyse the surplus arising in order to:

- show the financial effect of divergences between the valuation assumptions and the actual experience,
- exposing the assumptions that are the most financially significant
- show the financial effect of writing new business
- validate the calculations and assumptions used
- provide a check on the valuation data and process, if carried out independently
- identify non-recurring components of surplus,
- thus enabling appropriate decisions to be made about the distribution of surplus
- reconcile the values for successive years
- provide management information
- provide data for use in executive remuneration schemes
- provide detailed information for publication in the provider's accounts
- demonstrate that the variance in the financial effect of the individual levers is a complete description of the variance in the total financial effect
- give information on trends in the experience of the provider to feed back into the actuarial control cycle.

b) Surplus arises from comparing actual vs expected
Project revenue statement and balance sheet based on expected assumptions
Cashflow projection must be internally consistent
Cashflow model can be that built for the profit tests
…or a separate model designed for the specific purpose
Business plan cashflows would have been based on expected new business sales with expected experience. This can be projected by multiplying the cashflows with the sales volume expected.
The next step will be to model the effect of actual new business volumes
This will be modelled using the same cashflow model
With expected experience and actual new business volumes
The difference between the two models provides the effect of actual new business volumes
Lastly the effect of experience will be analysed
The actual sales volumes with actual experience
The difference between this model and the actual sales volume, expected experience will be the effect of actual experience
The effects of reinsurance should be modeled to show whether reinsurance has contributed positively or negatively to the profit line
sources of surplus/profit (deficit/loss) include:

- investment income and gains
- expenses
- commission
- taxation
- premiums/contributions paid/persistency
- claim amounts

[13]

Q.7)

a) reserve without reinsurance
Total Sum Assured = 4500 * 6 000 000 + 500 * 16 000 000 + 8 * 200 000 000
= 36 600 000 000 (= 3660 Cr)
Assuming mortality is distributed evenly over the period
Unexpired Risk = Total Sum Assured * 1/12 * Mortality Rate = 3 050 000 * 0.8/1000
= 2,440,000
Mortality Reserve = Unexpired Risk * (1 + Mortality Margin) = 2,440,000 * 1.1
= 2,684,000

b) Total claim amount paid to the client = 6,000,000 + 16,000,000 + 200,000,000 = 222,000,000
This will be all be paid by the direct writer.
CATEGORY 1:
60% * 5,000,000 = 3,000,000 for treaty 1.
Treaty 2 and Treaty 3 do not affect a claim for category 1.
CATEGORY 2:
60% * 5,000,000 = 3,000,000 for treaty 1
5,000,000 for Treaty 2
1,000,000 for Treaty 3
CATEGORY 3:
60% * 5,000,000 = 3,000,000 for treaty 1
5,000,000 for Treaty 2
185,000,000 for Treaty 3.
The reinsurance recoveries for each reinsurer would be:
Reinsurer 1: 3,000,000 + 3,000,000 + 3,000,000 = 9,000,000
Reinsurer 2: 5,000,000 + 5,000,000 = 10,000,000
Reinsurer 3: 1,000,000 + 185,000,000 = 186,000,000
Direct = 222,000,000-186,000,000 – 10,000,000 – 9,000,000 = 17,000,000

c) Sum at Risk for Direct Writer
category below
CATEGORY 1: 6,000,000 – 3,000,000 = 3,000,000
CATEGORY 2: 16,000,000 – 3,000,000 – 5,000,000 – 1,000,000 = 7,000,000
CATEGORY 3: 200,000,000 – 3,000,000 – 5,000,000 – 185,000,000 = 7,000,000
Total Sum At Risk for Direct Writer =
3,000,000 * 4500 + 7,000,000 * 500 + 7,000,000 * 8 = 17,056,000,000
Unexpired Risk = Total Sum At Risk * 1/12 * Mortality Rate = 1,137,067
Mortality Reserve = Unexpired Risk * (1+ Mortality Margin) = 1,250,774

d) The company has a proportional reinsurance arrangement. This may have been done for

1. technical assistance / availability of expertise,
2. capital benefits / financial benefits
3. increase the capacity of the direct writer

a large portion (60%) of the risk is ceded to the reinsurer.
This may be done to limit the risk exposure until experience in the new market is fully understood.
.. or to limit exposure due to small capital base of the company
The company also has Risk XL cover. This may have been done for

- Technical assistance
- Capital benefits
- Smoothing of results
- Increase the capacity of the direct writer
- Avoidance of large single losses

The company has a gap in its reinsurance cover between 5,000,000 and 6,000,000 – as well as another gap in its cover between 11,000,000 and 15,000,000. This exposes the company to some risk for larger claims.

The company does not have any cover above the 200,000,000 level.
This means that the company will be unable to automatically accept cases with cover above this level.
The case may be accepted if suitable reinsurance can be found but this cannot be guaranteed.
This may limit sales opportunities.
Catastrophe cover is purchased to cover a large loss from a single event
… to decrease the negative impact of uncorrelated events
.. such as an industrial accident

[18]

Q.8) Split fixed/variable.
Fixed expenses are those that do not vary with business volumes e.g. CEOs basic salary.
Variable expenses are those that vary directly according to the level of insurance business that is being handled at that time
.. and may be linked to the number of policies or claims or the amount of premiums or claims.
Split direct/indirect.
Direct expenses can be identified directly as belonging to a particular class of business.
Indirect expenses are those that do not have a direct relationship to any one class of business
All variable expenses are direct
but fixed expenses can be direct or indirect.
Split according to functionality
e.g. investment, acquisition, renewal etc.

(ii)
How to
Allocate as you wish the premium rates to be split,
so for personal business will split at least by product and possibly by cover
Link to business written or to claims..
Separate fixed and variable
Apportion indirect expenses across classes
Separate new business and renewal in theory if not practice
Why?
to get accurate costs / to cover expense costs overall
to get accurate rates
understand the level of cross subsidy in the rates
e.g. renewals subsidise new business if there aren.t different premium rates for each with the expenses split
understand the cost of writing business even if its not sold at the theoretically correct rate

[8]

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