INSTITUTE OF ACTUARIES OF INDIA

SUBJECT CA1 –Paper II

OCTOBER 2009 EXAMINATION

INDICATIVE SOLUTION

Q1.

a) The insurer has two options to manage the investment risk in the product

Option 1:

- ✓ buy shares in Sensex companies to provide the link to the index growth
- ✓ and buy a put option on those shares giving it the option to sell shares at a guaranteed level if need be

Option 2:

- ✓ buy a zero coupon bond to provide the guarantee of the minimum payment of return of the amount invested
- ✓ buy a call option on the Sensex to provide exposure to the growth in the equity market

b)

- ✓ Under option 1, 90% of the premium is invested in shares to create a tracking portfolio. The remainder of the premium buys the option. Dividend income from the shares is used to cover other financing costsand build the balance 10% of premium. Initial capital is required to cover costs until income builds up.
- ✓ Under option 2, the percentage of the premium invested will depend on three year zero coupon rates. The balance pays for the option and any other costs.

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Q2.

a) Risks involved are:

- ✓ Lack of any relevant data – for risk rates
  - o Difficulty in pricing
  - o Will have to rely on reinsurer's experience
- ✓ Lack of data on the potential market
  - o To anticipate the expected sales volumes
- ✓ Not selling enough volume to cover cost; as it is new to the market and to the sales force
- ✓ There will be a lot of development cost, which the company will want to recover over a period of time
- ✓ Training issues for the
  - o Sales force
  - o Operations staff
  - o Underwriters
- ✓ Initially the Critical illness definitions will vary a lot between insurers
- ✓ this will need a lot of training for the sales & operations staff to handle such queries
- ✓ Over the period the market to all settle towards a common set of definitions
- ✓ Most companies will initially rely on reinsurer's definitions
- ✓ Underwriting will be different from the other product's underwriting
- ✓ Additional training to existing staff or specialist to be recruited in the initial period
- ✓ Setting of waiting periods, cooling periods etc, exclusion clause
- ✓ Is the IT system equipped to handle or there may be some development issues

b) Risk can be reduced by

- ✓ Offering on Unit linked platform to avoid long term guarantee
- ✓ Reinsuring a large portion of the risk
- ✓ Having large margins in the premium rates
- ✓ Offering as a rider benefit rather than a stand alone

- ✓ Keep the design very simple for ease of understanding for the your staff and the customers
- ✓ Have it as an accelerated benefit instead of additional benefit

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Q3.

The investment and risk characteristic (of property investment)

- ✓ Size: large investment, very high level of initial expenditure and high level of future cashflow expected
- ✓ Indivisible: unlike a financial asset; this is a physical asset and cannot be subdivided into smaller identical units
- ✓ Unique: due to its physical characteristics and location
- ✓ Unmarketable: mainly due to all the above three characteristics
- ✓ There is unlikely to be a market (like a stock exchange) for expressways
- ✓ Unsuitable for smaller investors due to its large size and indivisibility
- ✓ Long term investment: an expressway will take a long time to build and also can be operated for a long period of time to generate revenue
- ✓ Until the construction is over; no positive cashflows
- ✓ Real asset: the revenue coming from the toll collections is likely to be linked to the inflation
- ✓ Cost of managing: compared to a financial asset, the cost of management is high. Specialist required to management an expressway
- ✓ Managing the expressway means that the investor has some degree of control over the cashflows generated by the toll, unlike the typical financial security which offers the investor a claim on a series of cashflows over which it has little or no control

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Q4.

A well run project needs

- ✓ A clear definition of the aim of the project, which reflects the need of the customer
- ✓ Full planning
- ✓ Thorough risk analysis
- ✓ Monitoring of development
- ✓ Measurement of performance and quality standards
- ✓ Thorough testing at all stages
- ✓ Care in managing different strands of the project to ensure that there are no necessary delays in one part of the project which depends on the outcome of another (critical path analysis)
- ✓ To move along at the appropriate pace so that the right things are done at the right time
- ✓ 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

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Q5.

Stochastic modeling could involve the following steps:

- ✓ specify the purpose of the investigation
- ✓ collect, group and modify data
- ✓ choose a suitable density function for each of the variables to be modeled stochastically
- ✓ specify correlation between variables
- ✓ ascribe values to the variables that are not being modeled stochastically
- ✓ construct a model based on the expected cashflows
- ✓ Check that the goodness of fit is acceptable. This can be done by running a past year and comparing the model with actual results

- ✓ attempt to fit different model if the first model does not fit well
- ✓ run the model many times each time using a random sample from the chosen density function (s)
- ✓ produce a summary of results that shows the distribution of the modeled results after many simulations have been run

[5]

Q6.

The three main measures of profit used by the company are:

1. Net Present Value (NPV)
2. Internal rate of return (IRR)
3. Discounted payback period (DPP)

Net Present Value:

- ✓ This is the expected present value of the future cashflows under a contract, discounted at the Risk discount rate (RDR).
- ✓ So when you choose different cashflows (say for different product lines) then we should choose the one with a higher NPV
- ✓ However this measure assumes
  - o A perfectly free efficient market
  - o The RDR used to discount correctly reflects the riskiness of the cashflows
- ✓ It is sensitive to the RDR chosen
- ✓ When comparing different products, where the risks involved are different, then comparing the NPV discounted at different RDR is not correct
- ✓ It is not a very simple measure to present to non-technical people
- ✓ It would by itself tell very little
- ✓ To use it by itself, we may need to express it as a ratio of other parameters like NPV as a percentage of expected Present value of premiums, initial commission, etc.

Internal Rate of Return:

- ✓ It is the discount rate at which the NPV is zero
- ✓ It is a simple measure
- ✓ It is compatible with shareholder saying “we want a return of at least x%.
- ✓ It is easily comparable with other forms of investment (e.g. other products, projects).
- ✓ But it might not be unique
- ✓ In some cases, it might not exist
- ✓ And it is difficult to relate to other measures (e.g. premium income)

Discounted payback period:

- ✓ This is the earliest policy duration at which the accumulated value of profit is zero.
- ✓ It is a useful means of comparing products if capital is a particular problem
- ✓ It is easy to explain as a “break-even” point.

- ✓ It will often not agree with the NPV as a means of deciding between two different sets cashflows because the DPP ignores cashflows subsequent to the DPP itself.

It does not give any indication of the overall profitability, while comparing two different product lines.

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Q7.

Employers’ Liability Insurance: Financially significant assumptions

- ✓ Claim amount and claim numbers
  - i. We need the distribution of the above two
  - ii. Since it is very long tailed class of business; significant provisions may build up prior to making claim payments

- ✓ Investment return
    i. It is an important assumption as it is a long tailed business

- ✓ Expenses – will be significant e.g. legal fees

- ✓ Commission – may or may not be significant, depending on the distribution method used

- ✓ Inflation
    i. Need assumptions for claims inflation and claims expense inflation
    ii. It is financially significant because it is relatively long tailed class of business
    iii. Claims could be subject to "court award" inflation
    iv. Inflation of legal expenses

b) How to set the assumptions

Claim amounts & numbers

- ✓ Statistical methods could be used to fit a distribution to past claim amounts and numbers and to solve for the parameters

- ✓ Such distributions would need to be adjusted in light of any changes e.g. in
    i. Policy cover – inclusion & exclusions, claim limits
    ii. Underwriting
    iii. Target market

- ✓ If insufficient data exists than industry or reinsurers' data would be useful.
- ✓ Advice from reinsurers may be useful anyway, even if sufficient data does not exist as reinsurers may have a better understanding of the industry

Investment return

- ✓ The Investment return assumption will depend on the types of assets and the mix of assets in which the premiums will be invested
- ✓ For example, if cash, bonds and equities are used we will need to project interest rates, bond yields, equity dividend yields and growth rates.
- ✓ Past data (e.g. from relevant indices) may be useful
- ✓ However, economic conditions change over time and therefore consideration needs to be given to he investment environment that is expected to apply over the future term of contracts
- ✓ Therefore if the past data is used it will need to be modified to strip out the fluctuations relating to the economic conditions of the time.
- ✓ The investment return may need to be "netted down" for
    i. Tax
    ii. Investment expenses

Expenses

- ✓ Expenses could be set by looking at the results from a recent company expense analysis for this product.

- ✓ However if insufficient data exists it may be necessary to use other sources of data for e.g.:
    i. The company's expense data of a similar contract
    ii. Industry data
    iii. Reinsurers' data

✓ Any past data will need to be modified for any aspects relating to the expenses which might be significantly different,..
✓ For e.g. Underwriting o claims administration

Commission
The insurance company will need to set its rates in line with the market for this type of contract, then just assume these actual levels in the pricing basis

Inflation (claims & claims expenses)
✓ Inflation assumptions are needed from the middle of the investigation period (from which any past data on claims and expenses has been taken) up to the middle of the period during which claims are expected to be paid.

✓ Industry inflation indices may exist for employer's liability claims and claims expenses.

✓ These would need to be extrapolated forwards

✓ Industry experts and reinsurers may help for e.g. they may be aware of any likely future court rulings/changes in legal fees which could affect the cost of claims and the associated expenses.

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Q8.

I. Asset share:
✓ It should be the starting point for determining any lump sum benefit
✓ This is the retrospective accumulation of past premiums, less expenses and cost of cover at the actual rate of return on the assets.
✓ It should be the maximum the company can afford to pay out over a reasonable period of time.

II. Policyholder expectations – discontinuance at short duration
✓ To compare lump sum discontinuance benefit after a few years duration with the premiums paid or even premiums plus some interest. However asset share at such stages would be usually less than the sum of premiums or even negative as significant initial expenses will have been incurred.
✓ If asset share is negative, company can't avoid making a loss.

✓ However it might be obliged to accept a loss or atleast a reduced profit, on discontinuance up to several yrs so that the lump sum paid does not appear too low compared to premiums paid.

III. Policyholder expectations – discontinuance close to maturity
✓ Expect that lump sum payable on discontinuance just prior to maturity will be consistent with it.
✓ It should progress smoothly into maturity value at the end of the contract.

IV. Competitive considerations: Company will want to be offering competitive surrender values as well as competitive maturity terms

V. Other consideration
✓ Customer expectations, which may be built up by disclosure in the policy literature e.g. sales illustration

✓ The ease calculation of the discontinuance benefits
i. Simple formula

ii. Table of factors
iii. Making the processing easier for admin staff

✓ The cost of implementing the discontinuance terms

✓ The frequency of change of the discontinuance terms
i. Should not change too frequently
ii. To reduce the risk of not meeting policyholder expectations
iii. Reduce the costs of determining and implementing new terms

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Q9.
Available source of capital
Deferring surplus distribution is one source of capital for an insurance company.

The surplus retained would be used within the business in the interim period

This is an important source for a mutual company as its options to raise capital is limited.

The extent of the deferral will depend on:
✓ Local regulation and relevant professional guidance
✓ The method of surplus distribution
✓ Policyholders' reasonable expectations

Margins for future adverse experience
✓ The more surplus the company holds back from distribution the greater the cushion it has against adverse future experience.

✓ The company will want to smooth surplus distribution from year to year, holding back surplus in good years to fund distribution in poorer years.

Business objectives of the company
✓ The company is likely to have as one of its business objectives as maximization of the surplus distribution to policyholders so as to improve its competitive position.
✓ If the company does not pay competitive payouts, its levels of new business may fall, with adverse effects for policyholders e.g. through less spreading of overheads.

However, meeting other business objectives will require capital and so tha company needs to be aware of the need to retain sufficient capital within the business to finance these activities for e.g.:
✓ Designing and launching new products
✓ Allowing appropriate investment freedom
✓ Meeting solvency requirements

Policyholders' reasonable expectations
Policyholders may have reasonable expectations as regards the form and level of the surplus distribution

Such expectations may be built up from:
✓ Documentation issued by the company
✓ The company's actual past practice
✓ The general practice in the LI market

Failure to meet these expectations will lead to policyholder dissatisfaction and risk of losing existing and/or new business.

Policyholder's reasonable expectations may also in some countries be grounds for intervention by the regulatory authority in the affairs of the company.

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Q10.

(a) Surplus Reinsurance:

- ✓ Proportional – the proportion can vary by each risk reinsured
- ✓ Written by treaty
- ✓ Cedant decides proportion to cede risk by risk, enabling the amount ceded to be managed by the size and variability of individual risks
- ✓ Premiums are split in same proportions as claims (if written on an original terms basis)
- ✓ Used to write larger and heterogeneous risks
- ✓ Reinsurer pays cedant a commission, which could be a source of capital
- ✓ Administration more difficult than QS.

(b)

1. Insurance company writing motor insurance
   - ✓ Occasional large liability claims (like multiple motor pile up)
   - ✓ Insurer would need individual or aggregate excess of loss reinsurance
   - ✓ Sufficient layers would be required to provide cover for any size of claim

2. a large insurance company writing industrial property fire insurance
   - ✓ These risks can be very large and individual companies would not want to retain all the risk on one policy
   - ✓ Insurer would need proportional insurance whereby the proportion in excess of the retention level is reinsured (the retention would vary by property)

     A surplus treaty would be required probably with quite a high maximum retention. A second surplus treaty may be required to cope with very large risks

[7]

[Total 100 Marks]

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