Institute of Actuaries of India

Subject CP1 – Actuarial Practice (Paper B)

November 2023 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)

- The annuity enables to customer to get regular income for remainder of his/her life post-retirement.
- Therefore, it largely passes the longevity and investment risk to the insurer.
- However, the annuities are illiquid in nature, therefore he needs to ensure that there are enough liquid assets to meet liquidity requirements like health-related expenditure.
- The return of premium (ROP) feature will ensure that the customer will gets his premium back in case of early death when only few annuity payments would have been made to him.
- The ROP can be used for incidental expenses like funeral etc on death or can be passed to beneficiaries.
- Since the annuity are priced conservatively it means that the cost of the return of premium will be lower than a term plan with similar sum assured
- The customer can choose the deferment period in case of deferred annuity where the annuity will start post-retirement when his income from other sources is likely to be lower thereby reducing the tax liability.
- It may be also beneficial as the investment gain during the deferred period may not be taxed.
- The fixed annuity payments are likely to be eaten by inflation.
- Linked annuities may be taken to protect against inflation, but the investment risk will be with the customer.
- In certain cases, it is regulatory requirement to purchase an annuity using a certain portion of the accumulated pension corpus.

[Max 4]

ii)

- The portion of each annuity payment needs to be segregated into two components:
  - The portion that will be taxed as earning.
  - The portion consisting of the return of the purchaser's investment.

- The tax authority may prescribe the basis to calculate the expected number of years over which annuitant is expected to survive to calculate the portion of the purchaser's investment in each annuity.
- The portion of the investment may be calculated using the simple formula: Investment in contract/expected number of years of payment.
- Example: if the initial investment is 30 lacs and expected number of years for survival is 20 years then the annual excludable amount will be 1.5 lacs.
- If an annuitant lives longer than the expected number of years used to calculate the tax liability, then the annuity posts that period will be fully taxable.
- However, if he dies before the expected number of years then deduction may be taken elsewhere in the final tax return of the annuitant.
- In case the annuity includes the return of premium feature then this will reduce the non-taxable component portion of the annuity.
- In such a case the present value of the refund component can be deducted from the initial investment to determine the non-taxable portion of the annuity.
- In case the annuity is offered on linked platform then it could happen that for certain period the annuity amount is less than deductible portion determined by the above formulae.
- The shortfall between the actual annuity paid and deductible component could be spread through the remaining period thereby increasing the deductible amount for the remining annuities.

- For example: If the deductible amount is 1.5 lacs and the annuity paid is 1 lac then 0.5 lacs can be spread for the remaining annuity period on an expected basis to increase the deductible amount. If the remining annuity period on the expected basis is 10 years, then the deductible will increase from 1.5 lacs to 1.55 lacs.
- The owner of the annuity may not be able to escape the tax liability by assigning the right to receive the payment to the third party.
- The tax authority could consider taxing the gain during the deferred period in case of deferred annuities. However, this may lead to double taxation as tax is applied on annuities on investment portion.
- Therefore, the taxation on investment income gain during the deferred period need to be excluded.
- It may also encourage people to save more.
- However, the deferred annuities may be used as short-term tax deferral investments.
- If no tax is payable on the investment return during the deferral period. If this feature is combined with a short guaranteed fixed period annuity certain say 5 years, then it leads to tax deferral.
- Therefore, to curtail this practice, the minimum age at the time of vesting may be prescribed like 58 years and any distribution before the age could lead to some kind of penalty.
- The need to pay early say due to certain situations like disability of the annuitant may be excluded from the penalty clause.
- Or the payment should be based on the life expectancy of the policyholder rather than some short defined fixed period otherwise some penalty may be applied.

[Max 5]

iii) The insurer can use the following different approaches to recognize the health impairments while determining the reserves:

- The actual age of annuitant and standard mortality rates:
  - The reserve would be prudent as there is no allowance to reflect substandard health of the annuitant.
  - This is likely to cause high new business strain and may not be the best approach.

- The rated-up age and standard mortality rate:
  - The rated up aged used for pricing can be used for determining the reserves.
  - The approach may presume that substandard rate may apply at all future durations and therefore the strain would be lower.
  - However, such an approach could lead to almost nil reserves if the policyholder survives to advance ages.
  - Example if the annuitant aged 60 is rated up by 25 years and considering that the standard table is published up to 115 years, the reserves will tend towards 0 around 90 years of age. If policyholder is alive post 90 years, then some positive reserves should be held.

- The actual age and substandard mortality
  - The approach will not lead to nil reserves as compared to the above approach and therefore may be a more appropriate method.
  - The substandard mortality used may be multiple of standard mortality or constant number of extra deaths.

- The actual age and substandard mortality that grades into standard mortality.

  - It will recognize the fact that as time passes the health of the annuitant who continues to survive will be closer to his normal peers.
  - As the health of the standard annuitant will deteriorate with time.

- The approach taken should be in line with the regulatory requirements.
- Or approach as per requirement of the APS/best practices in consultation with peer reviewer

[Max 6]

iv)

- The discount rate needs to be based on the on the riskiness of the asset and therefore could be based on the yield on the bond of the suitable term plus margin for factors like marketability etc
- The 10- or 20-year government bond may be used as a proxy for the risk-free rate in commercial real estate investing.
- An investment with low perceived risk will call for a lower discount rate.

The specific factors which may be considered while determining the risk discount rate for property are stated below:

  - Location of the property with poor location means a higher discount rate
  - Prospects of future rental growth
  - Prospects in growth of property value
  - The quality of the portfolio or the buildings: age, condition etc
  - Viability of the property to remain competitive in the future.
  - Potential capital expenditure
  - Development potential of the property
  - Quality of the tenants
  - Nature of the lease like short term vs long term, reviewability clause of rents
  - Economic factors like GDP growth etc.
  - Alternate use of property in case of downfall in the commercial demand

- However, in determining the discount rate, the objective of the investor with respect to return needs to be considered.
- For example, the investor may have a higher average cost of capital, so they need to achieve a higher return.
- Therefore, the discount rate will remain somewhat subjective and will differ from one investor to the other.

[Max 6]

v) Longevity Swap:

  - The insurance company pays a set series of payments to a third party.
  - In return it receives from the third party a floating set of payments that may be linked to the actual annuity payments made or linked to a population mortality index.
  - The mortality index needs to be agreed in advance as part of the contract.
  - The counterparty is likely to be a reinsurer or financial institution like a bank.
  - Collateral is normally required as part of the agreement.
  - The collateral payment would be calculated as the difference between the present value of the floating payments and the present value of the fixed payments.

  - If positive, then this amount of collateral would be posted by the third party; if negative, the insurance company would have to post this amount of collateral.
  - The present values would be calculated using a discount rate agreed by the two parties involved.
  - This is typically based on a swap curve.

- Counter Party Risk
  - The arrangements generate additional credit/counterparty risk.
  - i.e. the third party to which the risk has been transferred may default on the arrangement.
  - This may be due to the third party finding themselves in financial difficulties or becoming insolvent.
  - For the longevity swap, default is most likely to occur when the floating payments are expected to be higher than the fixed payments.
  - Collateral can be used in both cases to mitigate the risk.
  - Other counterparty risk controls, such as only transacting with high credit quality third parties,
  - The longevity swap may be traded through an exchange or other unrelated party, which helps to manage counterparty risk.

- Basis risk
  - For the longevity swap, if the floating payments are not based on actual annuity payments but on a mortality index then basis risk is introduced.

- Legal risk
  - The legal form of a longevity swap is often that of a derivative, rather than as a reinsurance contract.
  - Therefore, the contracts can be complicated, and so legal risk arises in relation to their interpretation.
  - Disputes may arise as a result of interpretation of contract.

- Liquidity risk
  - The liquidity swap may introduce liquidity risk in relation to margin calls.
  - The risk can also lead to capital strain/ insolvency of the insurer.

- Operational risk
  - There are a number of additional administrative operations that need to be undertaken.
  - Therefore, it can generate additional operational risk.
  - And there is related expense risk that the additional expense of administering the arrangements is greater than expected.

- Regulatory change risk
  - The effectiveness of both arrangements could change if regulations change.
  - Example the regulator may disallow such arrangements.

[Max 13]

vi)

- Innovative applications of digital technologies to prolong life expectancy, maintain physical capability and enhance the quality of life are emerging with increasing rapidity.

- The technologies/devices are now used in the home environment to provide personalized care to the patients.
- Individuals, being able to monitor one's health and wellness will provide empowerment and more personalised health and care provision.
- A conversation-based technologies backed by AI can be used to interact with the old annuitants.
- The solution will help in eliminating social isolation and keep aging minds sharp thereby improving outcomes for the old annuitants.
- Health monitoring technologies along with the quantified self-movement could revolutionize patient behaviour as they adopt healthy behavioural changes into preventative measures.
- For example, exercise or dietary intake
- The devices can be used to continuously monitor health of the patients and enable collection of the data.
- By knowing what happens between out-patient visits, treatment interventions can be fine-tuned to the needs of individual patients.
- Also, continuous monitoring of the health can indicate certain life-threatening diseases at onset.
- Early detection of changes in a person's health status (example progression of symptoms) can inform when clinical intervention is required potentially reducing hospital visits/ waits and improving quality of life and expectancy.
- The technologies therefore can reduce the cost of healthcare making it more affordable.
- If there is sudden change in the daily activity or health parameters, the device can alert care givers or call ambulance directly.
- However, the impact of the health-related wearable and monitoring devices will depend on the uptake of the same in medium to long term.
- The data privacy issue may remain a concern as some these apps make profit by selling of the data.
- The older age people like annuitants may not be that tech savvy which will further impact the adoption of the devices in the relevant population.
- The support from government, health community etc to encourage the take up of some of the available technologies could lead to increased usage in the future.
- The advancement in the technologies making them more accurate and user friendly will also increase the take up rate.
- In addition, the impact of the self-driving technology is expected to be reduce mortality from traffic-related accidents.

[Max 7]

vii) The reduction in the fund management expense (FME) will have financial implications on various aspects of the company, some of them are highlighted below.

- It will be possible to price the contracts more competitively due to an increase in the net earning rate on the plans.
- The change will have a higher impact on the guaranteed saving/annuity plans as opposed to pure protection or linked plans.
- The increase in the IRR may lead to higher sales there by increasing the volume.
- However, the extent of the increase will depend on the extent of the reduction in expense assumptions.
- This means lower per policy expenses and a further increase in the assets under management.
- The higher volume means higher commission for the distributor along with higher IRR to customers.
- It would lead to higher margins if the pricing were not revised to consider revised expense assumption for certain plans.

- This will lead to potentially higher bonuses to the participating policyholders.
- Higher bonuses mean higher transfers to the shareholders.
- The change will lead to the release of reserves in the respective financial year.
- This will lead to higher profitability in the year of the change.
- There will be scope to give higher dividends to the shareholder in year of the change
- However, the future release of margins from the reserves will reduce.
- The future new business strain will also reduce particularly on non-par savings plans/annuities
- The solvency capital requirement is also likely to reduce
- This will enable the insurer to write more business
- However, there will be reduced ability to absorb any expense related shocks in the future.
- There may be more scrutiny from the regulator due to release of the reserves in the annual review exercise.
- The tax liability will get accelerated as result of the release.
- The impact of the change on any expense overrun reserve and other maintenance expense assumptions needs to be considered.
- Any increase in reserve due to increasing the maintenance expense assumption will off-set the reserve release due to reduction in FME

[Max 9]

[50 Marks]

Solution 2:

i) Major risks faced by individuals and the types of insurance products needed to cover the risks.

a. Mortality risk: The risk of loss of the earning member of a family. Mitigated by purchasing Term life, Pure Endowment or Endowment insurance policies provided by life insurance companies
b. Longevity risk: The risk that an individual lives for long without sufficient income. Mitigated by purchase of annuity provided by life insurance companies or enrolling in any occupational pension schemes during the active working years.
c. Critical illness: Risk of critical illness during active working like. Mitigated by purchase of any critical illness policy provided by life or general insurance companies.
d. Risk of illness and hospitalization for an individual or family members. Purchase of Health insurance for self and family. The health insurance could be basic cover plus any top-up plans to take care of increasing health care costs.
e. Personal accident cover for self and family to cover the risk of death, injury, permanent or temporary disability and loss of income due to natural or manmade accidents.
f. Home insurance and home contents insurance to cover the risk of damage by Fire, theft, natural catastrophes or any other related peril. This is particularly needed due to the increased losses due to natural perils because of climate change and global warming.
g. Motor insurance cover for own damage, fire and theft of vehicles owned in addition to the compulsory third party cover.
h. Increasing use of internet and digital transactions for day-to-day activities has resulted in higher losses reported due to identity theft, data loss and ransom demand. This has necessitated the need for personal cyber insurance cover.
i. Insurance to cover the risk of unemployment or loss of job due to changing economic situations. This could be purchased as standalone cover or addon cover to home insurance.

j. Crop insurance cover and livestock insurance cover for individual farmers and villagers as needed.
k. Any other valid point that includes the risk faced and mitigation

[Max 8]

ii) Major hurdles faced by the government of country A and its mitigation.

a. Insurance awareness and lower insurance penetration: The government and regulator may create campaigns to create awareness about the different risks faced by individuals and the types of products available to mitigate the same.
b. Number of insurance companies in country A and their ability to provide insurance cover to the large and diverse population. The existing companies could be incentivized to meet the emerging demand.
c. Barriers to the entry of new insurance companies: Changes in laws and regulations to encourage corporate houses to start insurance subsidiaries. Enabling provisions to attract foreign investment insurance business.
d. Affordability of insurance for the individuals. The government may provide subsidies to the insurers or insured. The government may also act as a reinsurer of the last resort.
e. Availability of products to cater to the needs of individuals. Creation of simple and standard products that are easy to understand for the masses.
f. Reach of the insurance companies and distribution of insurance products: The regulator may assign individual insurance companies as 'lead insurer' to each state or province.
g. The challenge to cater to the diverse population based on the economic conditions. In addition to standard products, the insurers may also provide micro insurance products.
h. Availability of capital for insurers. The government may promote regional or micro insurance companies who provide fewer products in a smaller geographical area. This will help reduce the capital requirements.
i. Ensure availability of sufficient reinsurance capacity in the market. New insurers will need higher reinsurance protection in the initial growth phase. Also, the existing insurers may be ceding larger proportion of their premiums in the rapid expansion phase.
j. Changes in regulatory environment for the insurers to engage with multiple and diverse channels for distribution of insurance products.
k. Any other valid point

[Max 8]

iii) In insurance parlance, capital is defined as the funds held in excess of what is needed to meet the insurance liabilities or future obligations to policyholders. In simple terms it is measured as the difference between how much funds the insurance company have and how much is needed.

An insurer can raise capital from the following sources.

a. Retained profits: Any profits or surpluses retained within the business and not distributed as dividend or bonus forms a part of the capital.
b. Equity capital: Owners of the company provide equity for which they receive dividends that are paid out of the profits made by the company.
c. Debt capital: providers of debt are the creditors of the company.
d. Mutuals usually raise the capital from their members.
e. Reinsurance companies could be an indirect source of capital for direct insures by taking on their labilities thereby reducing the amount of required capital.

f. Government of a country or state could provide capital to insurers with a specific social objective like rural insurance or micro insurance.
g. Financial reinsurance or FinRe is another arrangement through which insurers can raise capital.
h. Securitization is another mode of raising capital. It involves converting an illiquid asset into tradeable instruments. This is also known as "off balance sheet" treatment.
i. Other banking products like liquidity facilities, contingent capital, senior unsecured financing, derivatives etc. to raise capital in short term. Such arrangements could be mode of raising capital pre or post incurring of a loss. Such methods are collectively termed as alternate risk transfer.
j. Any other valid point.

[Max 6]

iv) Need for moving to Total balance Sheet Approach to calculate Capital.

a. Given that the future is uncertain, capital may be required in addition to the provisions held to ensure the promised made to the insured are met.
b. In addition to the underwriting risk, insurers face a variety of risk including market risk, credit risk, currency risk, liquidity risk, operational risk etc. for which adequate capital may need to be held.
c. A large number of factors are required to capture all the risks faced by an insurer that is not possible in a simple formula-based approach.
d. A simple calculation may not be appropriate to deal with all types of risks. Moreover, the capital calculations need to be constantly monitored and revised in the light of changing conditions.
e. A simple formula-based approach is one size fits all approach appropriate for an average company that may not capture the risks specific to each insurer, hence a more comprehensive method is needed.
f. Total Balance Sheet Approach is a concept that recognizes the interdependency between assets, liabilities, risk assessment and solvency capital requirements.
g. Unlike the simple formula-based method, this method includes all assets and liabilities of the insurer and not just the assets backing the liabilities.
h. It recognizes the impact of all material risks that affect the overall financial position of the insurer.
i. In addition to the insurer's technical provisions, the RBC approach involves the assessment of required capital and available capital sources.
j. The fundamental principle underlying this method is that the different aspects of solvency assessment are inter-related and cannot be considered in isolation.
k. Assets are considered at market value, fair value or at a value in an arm's length transaction.
l. The value of assets is calculated as the present value of future cashflows taking into consideration the relative riskiness of the same.
m. The technical provisions are valued on commutation basis or the value at which the insurer will transfer immediately its obligations to another insurer or a reinsurer.
n. The technical provisions are calculated at the best estimate value plus a margin for risk.
o. In addition to the technical provisions, liabilities of the insurer other than the insurance liabilities are also considered.
p. Capital has a cost associated with it. Hence the need for holding an optimum amount of capital that is sufficient considering all the risks faced by the insurer.
q. Any other valid point.

[Max 10]

v) Monitoring of experience is primarily done to review the validity of models and assumptions.

a. Monitoring is also a part of the risk management control cycle to review the risks faced by the company and evaluate the effectiveness of the risk management strategy.
b. Monitoring of experience is a fundamental part of the actuarial control cycle.
c. The environment in which the insurer operates is constantly changing and monitoring of experience is essential to revise the risk management and business strategies.
d. Comparing the actual experience with the expected helps to check whether the assumptions used continue to be appropriate or not.
e. In an insurance company the pricing assumptions need to be compared with the emerging experience and corrective actions taken to ensure that the stated objectives are met.
f. In addition, any trends in experience, adverse or favorable are monitored to take timely corrective actions.
g. Monitoring of business helps provide feedback and update the MIS systems to help all stakeholders take informed decisions.
h. Monitoring of experience also help in validating and identifying any past trends, cycles and anomalies in the data that forms part of pricing and other models.
i. The results of monitoring of experience are essential for an actuary to set future assumptions.
j. The results of experience monitoring will help set margins for future prudence.
k. Monitoring of experience helps in assessing the relative profitability of different products or blocks of business.
l. Monitoring of business helps to assess the adequacy of reinsurance, capital, and solvency position.
m. Any other valid point

[Max 6]

vi) Major factors that need to be considered while designing an insurance contract

a. No insurer can assume unlimited risk and hence the contract between the insurer and insured determines the benefits the insurer is legally required to pay.
b. Insurance contracts are governed by the principle of utmost good faith which requires that the insured need to disclose all material facts that relate to the risk to be covered.
c. The terms and conditions are drafted by the insurer in a fair manner and are mostly standardized. However, they are generally considered contracts of adhesion because insured has no ability to make material changes to it.
d. The insurer bears the burden if there is any vagueness in any terms or conditions of the contract.
e. If there are no adequate terms and conditions the cover will become open ended and unlimited which will be unfair to investors and providers of capital to share the risk.
f. The contract must meet the needs of a wide range of customers hence the insurer must be fully aware of the risk appetite of the potential policyholders, the desired benefits, and their capacity to pay for the benefits.
g. The contract must be designed in such a way that the potential policyholder's reasonable expectations are met.
h. The marketability and competitiveness are a major factor of the contract. This will depend upon the similar products offered by other players in the market and the cost of the same. However, this may potentially conflict with the profitability of the contract.

i. The level of risk that the insurer is willing to take will depend on the available capital and mitigation strategies including reinsurance. This must be properly captured in the contract design.
j. The contact must explicitly state the level and form of benefits. This will include whether it meets the full cost of the treatment, a fixed percentage or there is an excess applied to each claim. The benefits also need to integrate with any state provision.
k. Any optional benefit is likely to create a risk of anti-selection. Moreover, any cross subsidies may result in the insurer being exposed to a risk that the mix of business is different from expected.
l. Any guarantees provided in the contract must be explicitly and unambiguously stated in the contact to avoid potential future litigations.
m. It needs to be ensured that the terms and conditions of the contract are not so tight that they affect the marketability of the product and not so loose that it may result in unexpected claim payouts.
n. The terms and conditions of any new contract need to be consistent with other contracts of the insurer to avoid discontentment from existing policyholders.
o. It is essential that the opinion of experts viz. lawyers, reinsurers, medical experts is sought while designing the contract. The opinion of the actuary is also needed to ensure that all the contract terms are considered in the pricing of the product.
p. The premium payment patterns and its accounting implications must be considered while designing a contract.
q. Any contract essentially impacts the capital requirements and solvency of the insurer. Hence the contract needs to be designed in such a way to optimize the capital requirements and minimize volatility in profits and solvency.
r. All the statutory and regulatory requirements need to be adhered to while designing a contract.
s. It needs to be ensured that all the standard clauses are included in the contract and the wordings are consistent with what the market is offering.
t. Any other valid point.

[Max 12]
[50 Marks]

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