INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

SP4 – Pension and Other Benefits

May 2025

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.

Q.1)

i)

A.Risks to the Government (Actuarial Perspective)

- Open-ended liability risk due to defined benefit promises without clear asset backing.
- Longevity risk increases long-term payout obligations beyond projections.
- Indexation risk: Inflation-linked increases can escalate fiscal burden over time.
- Underfunding risk: Contributions (10% + 8.5%) may be actuarially inadequate.
- Investment risk: Pension fund returns may not meet assumed discount rate.
- Demographic shift risk: Increasing ratio of retirees to active employees.
- Intergenerational fairness risk: Future taxpayers may subsidise current entitlements.
- Volatility in government budgets due to fixed pension outflows in downturns.
- Political risk: Future expansion or relaxation of rules increasing liabilities.
- Operational risk: Errors in member records or delays in processing claims.

B. Risks to Employees (Actuarial Perspective)

- Irrevocable opt-in risk: Lock-in limits future flexibility for changing circumstances.
- Pension adequacy risk: Final benefits may not meet retirement needs for low earners.
- Inflation underestimation risk: Erodes real purchasing power post-retirement.
- Pension formula rigidity: Limited link to individual contribution or career progression.
- Job mobility constraint: Full pension only after 25 years discourages early movers.
- Information asymmetry: Employees may not understand scheme structure and trade-offs.
- Limited annuity options: May not cover longevity variations or inflation protection post-retirement.
- Withdrawal risk: Poor financial planning post 60% lump sum withdrawal.
- Family pension uncertainty: Survivor benefits may be inadequate or poorly timed.
- Delays or errors in pension processing due to poor record keeping.

(Max 10)

ii)

A. Mitigation Measures for Government-Level Risks

- Conduct regular actuarial valuations to project liabilities and ensure funding adequacy.
- Establish a funded reserve with transparent investment and withdrawal policies.
- Apply conservative assumptions (longevity, inflation, discount rate) with margin for prudence.
- Cap inflation indexation through formula-based escalations to reduce volatility.
- Introduce longevity-linked pension formulas to mitigate long-term risk.
- Use stochastic modelling to simulate demographic and economic scenarios.
- Create a pension oversight board with independent actuarial representation.
- Set maximum liability thresholds based on percentage of GDP or tax revenue.
- Mandate fiscal provisioning in annual budgets for accrued pension liabilities.
- Streamline digital record-keeping to ensure accurate data and tracking.

B. Mitigation Measures for Employee-Level Risks

- Allow a limited exit window to increase flexibility for participants.
- Provide contribution top-up options for members seeking enhanced retirement income.
- Educate employees on scheme features through regular workshops and portals.
- Introduce a progressive pension scale to improve benefit adequacy for low earners.
- Enable limited portability to other public sector schemes.
- Offer both lump sum and annuity options for the 60% withdrawal portion.

- Simplify pension benefit statements to aid transparency and understanding.
- Implement biometric verification to streamline disbursements and reduce fraud.
- Automate survivor pension initiation to support families' post-death.
- Regularly review and adjust minimum pension in line with cost of living indices.

(Max 10)

[20 Marks]

Q. 2)

i) Key actuarial assumptions in an insurer buy-out context

General Principles

- Insurer's actuarial assumptions aim to estimate the cost of securing promised benefits under regulatory solvency frameworks.
- Reflect prudence to ensure liabilities are not underestimated under stressed scenarios.
- Include allowances for potential adverse experience and data uncertainties.

Discount Rate Assumptions

- Based on the expected yields on high-quality fixed-interest assets such as government and corporate bonds.
- Incorporates conservative assumptions, including profit and solvency margins.
- Typically set lower than discount rates used in ongoing scheme valuations to reflect reduced investment risk appetite.

Inflation and Pension Increases

- Assumes future inflation-linked increases on pensions in payment and revaluation of deferred pensions.
- Excludes future salary growth, given buy-outs typically exclude active members' salary-linked liabilities.

Mortality Assumptions

- Employs calibrated base tables (e.g., S2), often customised with postcode-level mortality analysis.
- Differentiates between members and dependants (e.g., spouses), reflecting their distinct longevity profiles.
- Incorporates up-to-date longevity improvement models (e.g., CMI), with conservative long-term improvement rates.

Other Demographic Assumptions

- Proportion married and spouse age difference assumptions based on demographic profiles.
- Commutation rates to account for the proportion of members taking tax-free lump sums.
- Potential transfers out and trivial commutations if permitted.

Contingency Provisions

- Additional loading for uncertain or incomplete data (e.g., missing spouse information).
- Explicit allowances for administration costs, regulatory compliance, and risk capital.
- Asset strategies differ: insurers discount liabilities with reference to low-risk fixed-income investments.
- Scheme valuation assumptions may be shaped by legislative funding requirements or trustees' objectives.

(Max 9)

ii) Discuss the main challenges an actuary may face when reconciling the liabilities valued by the scheme actuary for funding purposes with those calculated by the insurer for pricing a buyout.

- Different valuation purposes: Funding focuses on contribution planning, while buyout focuses on risk transfer.
- Stricter data requirements: Insurers need more complete and accurate member data.
- Discount rate differences: Funding may use expected returns; insurers use market-consistent bond yields.
- Inflation assumptions: Scheme actuary may use smoothed inflation; insurers use market-implied rates.
- Mortality assumptions: Scheme actuary may use standard tables; insurers apply detailed demographic analysis.
- Member options: Different assumptions for commutation, early retirement, and other member behaviours.
- Expense loadings: Insurers explicitly allow for future administrative and claims expenses.
- Benefit interpretation: Differences may arise in interpreting scheme rules, especially discretionary benefits.
- Capital and risk margins: Insurer liabilities include margins for solvency capital requirements.
- Timing of valuations: Changes in market conditions can cause differences if valuations are done at different times.

(Max 5)

iii) Explain the strategic rationale a pension scheme trustee board might have for completing a buyout in stages rather than in a single transaction.

- Manage market risk: Reduces exposure to interest rate and pricing volatility over time.
- Access insurer capacity: Breaking into smaller tranches can make the deal more manageable for insurers with limited capacity.
- Enhance insurer competition: Staggered transactions allow trustees to engage multiple insurers and potentially secure better pricing.
- Allow time for data improvements: Provides an opportunity to cleanse and refine member data before final transactions.
- Facilitate investment de-risking: Gradual buyouts give time to adjust the scheme's asset portfolio to align with insurer pricing.
- Increase affordability: Phased transactions may better align with the scheme's available funding or sponsor contributions.

(Max 3)

[17 Marks]

Q. 3)

i) Key Differences Between Entry Age Method (EAM) and Projected Unit Method (PUM)

- Cost Allocation Approach:
  - *EAM*: Spreads the total cost of benefits evenly over the member's entire career (entry age to retirement).
  - *PUM*: Allocates cost based only on benefits accrued in the next year, though projected on future salary.
- Contribution Stability:
  - *EAM*: Results in stable, level contributions as a percentage of salary over time.
  - *PUM*: Contributions can increase sharply as the workforce ages or membership matures.

- Actuarial Liability Profile:
  - *EAM*: Liability grows gradually and smoothly over the member's career.
  - *PUM*: Liability increases more rapidly as members near retirement, due to accumulated service.
- Treatment of Past and Future Service:
  - *EAM*: Considers total service (past and future) when setting contributions.
  - *PUM*: Focuses only on accrued past service and the next year's accrual.
- Sensitivity to Salary Increases:
  - EAM: Salary increases are factored in from entry age, smoothing out the effect over the member's career.
  - PUM: Salary increases have a bigger impact as members' approach retirement because liabilities are based on final or projected salaries over shorter periods.

(Max 5)

ii) Why Entry Age Method is More Appropriate for Funding in This Case

- Long-Term Stability:
  - The method ensures a stable funding plan over the long term, avoiding large jumps in contribution requirements as the scheme matures.
- Matching with Scheme Objectives:
  - Ideal for sponsors aiming for intergenerational equity, i.e., each cohort of employees funds their own benefits.
- Avoids Contribution Volatility:
  - Prevents spikes in contribution rates when a scheme's active membership is ageing – a concern under PUM.
- Consistent with Funding Objectives:
  - Funding valuations often aim for long-term solvency and contribution predictability, rather than short-term expense recognition (which is PUM's focus in accounting).
- • Early Recognition of Total Cost:
  - EAM: Recognizes the cost of benefits earlier in an employee's career, reducing the risk of underfunding if future salary growth or workforce turnover assumptions don't materialize as expected.

(Max 5)

iii) When PUM Might Be Preferred for Funding

- Mature Schemes:
  - Where the majority of members are close to retirement, PUM may better reflect the true cost of accruing benefits.
- Alignment with Accounting:
  - If the sponsor wants alignment between funding and accounting figures (e.g., under IAS 19), PUM can provide that consistency.
- Short-Term Funding Objectives:
  - If the funding strategy is short-term or cash-flow driven, PUM may offer a better reflection of near-term liabilities.
- Flexibility for Changing Workforce:
  - PUM: More adaptable when there is high workforce turnover or restructuring, as it focuses on short-term benefit accruals rather than long-term projections.

(Max 3)

[13 Marks]

Q. 4)

i)

- Actuarial deficit: Occurs when the pension scheme's liabilities (the value of promised benefits) exceed its assets, meaning there are insufficient funds to meet future obligations.

- Actuarial surplus: Occurs when the pension scheme's assets are greater than its liabilities, meaning there are excess funds beyond what is required to meet future obligations.

(2)

ii) **Deficit implications**:

- The scheme may become unable to pay full member benefits, especially if the employer faces financial difficulties.
- The longer the deficit is ignored, the larger it may grow, requiring higher future contributions.
- Regulatory authorities may impose strict funding recovery plans or penalties.
- The employer's reputation may suffer, particularly for a listed parent company under market scrutiny.
- The deficit may be treated as a liability by credit rating agencies, affecting the company's financial standing.

Surplus implications:

- Capital remains locked in the scheme, reducing funds available for business investment or other uses.
- Scheme members may miss out on possible benefit enhancements or reduced contributions.
- Tensions may arise between trustees, members, and employers over how to allocate or use the surplus.
- Some jurisdictions may tax or restrict the return of surplus to the employer, reducing flexibility.
- Continued surplus may lead to reduced attention to funding risks or investment performance.

(Max 5)

iii) Data the actuary would require to evaluate progress in addressing the deficit:

Two years after the most recent valuation revealed a deficit, the actuary needs the following information:

- Changes in benefit structure or scheme rules: Any amendments affecting future benefit accrual or member entitlements (e.g., pension increases, commutation terms).
- Details of scheme assets and liabilities from the previous valuation.
- Investment returns achieved during the two years since the last valuation.
- Contributions made by the employer and members during this period.
- Demographic data on scheme membership, including retirements, deaths, new joiners, and early leavers.
- Assumptions used to project liabilities (e.g., salary growth, inflation, and longevity).
- Expenses and charges: Scheme administration and investment management expenses that may affect asset growth.
- Transfer values paid out: Information on any significant bulk or individual transfers out of the scheme.

(Max 4)

iv) To address the deficit and achieve the required funding level within the range of 95%–105% with a 90% confidence interval, the sponsoring employer may consider the following measures:

1. Increasing Employer Contributions:

- Raise regular contributions to provide a steady source of funding over the next 4 years.
- Make one-off lump-sum contributions to immediately reduce the deficit.

2. Increasing Member Contributions (if applicable):

- Require employees to contribute higher amounts to share the burden of deficit recovery.

3. Revising Investment Strategy:

- Target higher returns by investing in riskier assets, ensuring an appropriate risk-reward balance.
- Diversify the investment portfolio to reduce the chance of underperformance.

4. Adjusting Benefits:

- Lower future benefit accrual rates to reduce the scheme's liabilities.
- Increase the retirement age or change salary growth assumptions to align liabilities with expected funding.

5. Scenario Testing:

- Perform stress-testing and scenario analysis to evaluate the impact of adverse economic conditions on asset growth and liabilities.
- Use results to refine the funding strategy further.

6. External Support from the Parent Group:

- Seek funding injections or guarantees from the parent group to help meet the deficit within the target funding range.
- Negotiate shared resources or expertise to enhance funding practices.

These measures should be implemented with careful consideration of regulatory requirements, scheme member interests, and long-term sustainability.

(Max 6)

v) Advantages:

- Consistency Across the Group: Ensures uniform standards in funding policies, enhancing the parent group's reputation.
- Regulatory Compliance: Aligns the subsidiary's practices with the parent group's listed entity requirements and market expectations.
- Financial Stability: Encourages the subsidiary to maintain disciplined and sustainable pension funding, reducing long-term risks.
- Expertise and Oversight: The parent group can provide resources, expertise, and guidance to help the subsidiary address funding challenges.
- Investor Confidence: Adhering to stringent policies can reassure investors and stakeholders about financial discipline within the group.

Disadvantages:

- Loss of Autonomy: The subsidiary may feel restricted in tailoring its pension scheme management to local conditions and member needs.
- Financial Pressure: Strict policies may impose significant strain on the subsidiary's finances, particularly in volatile or challenging markets.
- Risky Investments: The subsidiary might adopt riskier investment strategies to meet the required funding range within a short timeframe.
- Resource Dependency: Reliance on the parent group for funding support could undermine the subsidiary's independence and financial planning.

- Over-Regulation: Policies designed to meet parent group requirements may not account for the unique context of the subsidiary, potentially leading to inefficiencies or member dissatisfaction.

(Max 6)

[23 Marks]

Q. 5)

i)

1. Early retirement options — allowing members to retire earlier than the normal retirement age with reduced benefits.
2. Phased retirement — members can gradually reduce their working hours while drawing part of their pension.
3. Additional voluntary contributions (AVCs) — members can contribute extra funds to increase their pension benefits.
4. Spouse/partner benefits — allowing members to elect for spousal pensions upon death.
5. Indexation of pensions — offering inflation-linked increases to pensions post-retirement.
6. Enhanced retirement options — where members can increase their pension by purchasing additional years of service.

(Max 3)

ii) Describe how the actuary might carry out an analysis to estimate the likely proportion of members who would take the increased 60% lump sum option. Historical take-up rates — The actuary would analyse past data where 80% of members took the 25% lump sum.

1. Segment members by characteristics — Age, pension size, health, and financial status can influence the likelihood of opting for a higher lump sum.
2. Model behaviour — Using behavioural economics models to assess how a larger lump sum might influence members' decisions.
3. Financial advice and communication — Consideration of how well members understand the 60% option, whether they receive financial advice, and how it might influence their decision.
4. Simulation — Use actuarial modeling to simulate various scenarios for take-up based on historical behaviour and the new 60% option.
5. Benchmarking against similar schemes or industry data: The actuary can review how members in other schemes responded when offered similar enhanced lump sum options, providing a useful external reference point.

(Max 5)

iii) Describe the potential implications of the change to a 60% lump sum option for the scheme's funding, cash flow, investment strategy, and risk profile.

Funding Implications:

- Reduced liabilities: By allowing larger lump sums, the scheme may reduce its ongoing liabilities because fewer members will receive long-term pensions.
- Higher cash outflows: If a large number of members take the maximum lump sum, the scheme will face significant immediate cash outflows, which could affect its funding level.

Cash Flow Implications:

- Immediate liquidity requirements: The scheme will need to ensure it has enough liquid assets to meet higher lump sum demands.
- Lower future pension payments: Fewer ongoing pension payments may improve cash flow in the long term, but higher initial outflows could strain the scheme's finances.

Investment Strategy Implications:

- Change in asset allocation: The scheme may need to shift to more liquid assets (e.g., short-term bonds or cash) to handle the immediate lump sum payments.
- Long-term investment horizon: Reduced liabilities could shorten the time horizon for investments, which could influence the scheme's overall strategy.

Risk Profile Implications:

- Lower longevity risk: With more members taking lump sums, the scheme will reduce exposure to longevity risk, as fewer pensions will be paid over time.
- Higher investment volatility risk: If large lump sum payments are taken, the scheme may become more sensitive to investment market fluctuations, particularly if they need to liquidate assets to fund these payments.

(Max 6)

iv) Discuss the advantages and disadvantages of requiring scheme manager consent for members to commute more than 25% of their pension into cash.

Advantages:

1. Control over cash outflows: Scheme managers can control the total amount of cash paid out, avoiding excessive immediate cash drain.
2. Risk management: By requiring consent, the scheme can ensure that members fully understand the long-term implications of converting a large portion of their pension to cash.
3. Better planning: The scheme can better plan for the financial impact of lump sum payouts.

Disadvantages:

1. Increased administrative burden: Approving each request may require additional resources and administrative processes.
2. Member dissatisfaction: Members may feel restricted and frustrated by the approval process, leading to dissatisfaction and a negative perception of the scheme.
3. Potential delays: The need for consent could delay retirement decisions and the disbursement of funds.
4. Perceived lack of flexibility: It may be seen as too paternalistic or controlling, reducing members' sense of autonomy in managing their pensions.

(Max 5)

v) Discuss the advantages and disadvantages of each approach for setting commutation factors.

Option 1: Link the commutation factor to prevailing interest rates.

Advantages:

1. Market alignment: Interest rates directly influence the cost of funding pensions, so linking commutation factors to interest rates ensures the scheme remains aligned with the market.
2. Transparency: Members can easily understand how interest rates affect their lump sum, making the process more transparent.

Disadvantages:

1. Volatility: Interest rates fluctuate, which could lead to significant changes in commutation values from year to year, making it harder for members to plan their retirement.
2. Unpredictability: The scheme's funding position could become more volatile, as interest rate movements could have a significant impact on the liabilities.

Option 2: Set a fixed commutation factor recommended by the scheme actuary.

Advantages:

1. Stability: A fixed factor provides more stability and predictability for both the scheme and members, as it does not change frequently with market conditions.
2. Long-term planning: Members can plan their retirement more easily, knowing that the commutation factor is fixed for a longer period.

Disadvantages:

1. Inflexibility: The fixed factor may become misaligned with market conditions over time, especially if interest rates or inflation change significantly.
2. Risk of underfunding: If the fixed commutation factor is not adjusted in response to changing economic conditions, the scheme may face underfunding issues in the long term.

(Max 8)

[27 Marks]

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