

Institute of Actuaries of India

Subject ST4 – Pension & Other Employee Benefits

May 2015 Examinations

INDICATIVE SOLUTIONS

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) Benefits / options**

- An option for a lower initial pension, but with subsequent increases in payment
- ..e.g. at fixed rate
- ..or in accordance with an index of prices
- Ability for part of the accumulated investment to be taken in the form of a cash sum, rather than a pension
- An option to elect to take benefits earlier than the specified date
- ..e.g. on ceasing employment
- or ill-health retirement
- ..or later than the specified date
- an option to take a transfer value to an alternative pension scheme
- ..e.g. after leaving service
- Using the accumulated fund to provide dependants' benefits before or after retirement
- ..e.g. as a lump sum or an annuity
- ..to spouses, legal or common law
- ..or dependant children
- ..e.g. up to a specified age, e.g. 25
- allow some form of income drawdown, perhaps depending on fund size at retirement
- Consider provision of a lump sum or annuity related to salary / service on death in-service, usually insured with an insurance company
- or specified benefit if retirement on ill-health grounds
- ..With the cost of the insurance met out of the contribution rate. [5]

(ii) Practical issues

- Need to satisfy any legislative constraints
- or scheme rules
- ..e.g. maximum rates of increase in payment, maximum lump sum benefits, retirement ages, level of
- spouses pensions
- How often the options chosen can be changed
- ..e.g. the balance between benefits payable before and after retirement
- ..and / or to reflect changing personal circumstances
- ..such as marital status, names of dependants, number and age of children
- ..but to prevent selection
- ..e.g. members wishing to increase death benefits if in poor health
- Determining what evidence of health is required initially in respect of death benefits payable before retirement which are in excess of the accumulated fund
- Deciding the ages between which retirement benefits can be taken
- ..e.g. can this be before the employee leaves employment, so that retirement benefits concurrent with employment
- Setting a minimum level for the annuity in payment
- ..to avoid the payment of trivial pensions
- Determining what medical evidence is required to permit an ill-health early retirement pension
- Determining a methodology for assessing the yearly cost of the insured benefits

- ..e.g. a variable cost to reflect each year's risk, or alternatively an average cost over the period to retirement
- Need to be able to explain options to members
- aim to simplify administration
- probably wish not to over engineer any conversion terms

[5]

[10 Marks]

Solution 2 :**(i) Corporate bonds****Vs. Equities**

- Higher priority than equities regarding payment of income (or capital redemption) less risky
- Depends on the gearing of the company issuing bonds/equities
- Both issued by corporate entities
- Similar marketability
- Pre-determined payments no scope for extra return

Vs. Government bonds

- Minimal default risk with government bonds
- Some default risk with corporate bonds
- More risk on income and capital redemption compensated by higher yield
- Smaller issues; Less marketable
- Less variety (of terms, coupon etc.) depending on development of corporate bond market
- Index-linked corporate bonds may not be available

Vs. Cash

- Less secure
- Higher return? depending on shape of yield curve
- Less marketable / liquid

[6]

(ii)

On one measure the scheme is in deficit and therefore the trustees must be concerned about security.

If investments are all moved into corporate bonds it is that (Company accounts) valuation which shows a deficit. Therefore unless there are other margins in that valuation, a corporate bond investment strategy would serve to match the liabilities and preserve the deficit.

Over the long term the bond strategy may be expected to produce a lower return than equities and hence the cost of the scheme will increase to the company.

That increase in cost over the long term may be just a likely as short-term fluctuations in the accounting cost to force the company in considering the viability of the scheme.

If the company stops pension provision in the future this is a concern for the trustees as members will stop getting benefits.

Also need to consider the possibility of wind up and the priority liabilities.

Trustees should be seeking to maximise return subject to reasonable degree of risk.

The company's attitude seems to be very short term rather than the longer time horizon over which the trustees view the scheme.

The following additional points should also be considered.

- Matching of mortality risk
- Strength of sponsoring employer
- Constraints in legislation or the governing documentation
- Lack of diversification

[4]

(iii) Additional Information Required for the ALM exercise

- Period over which the exercise is being conducted
- The acceptable level of accuracy of the results (tolerance)
- The acceptable level of risk the client is willing to accept
- All the usual membership data, assets etc that was used for the funding valuation is needed.
- Any options and guarantees not explicitly valued in the funding valuation are required for the fully realistic ALM assessment.
- The funding method and assumptions used in the funding valuation and the conclusion as regards the future contribution rate.
- Realistic, no margin, assumptions for pay, inflation and investment growth.
- Realistic demographic assumptions including withdrawal, proportions taking transfer values, new entrants, cash commutation proportions, early retirements, and any other options.
- Covariance (standard deviation/correlation) of the asset classes.

[4]

(iv)

- Company cost in the accounts fluctuates by $>x\%$ once every y years
- Actual contributions increase to more than Rs. xm in any year in next 10
- Ongoing funding level $< x\%$ once every y years
- Discontinuance funding level $< x\%$ once every y years

[2]

[16 Marks]

Solution 3 :

(i) Financial

- The main financial risk is that the actual costs are unknown in advance.
- An actuarial projection of the cost of the benefits will have established a suitable funding level but the actuarial assumptions may prove to be too optimistic.

- Mortality (both pre and post retirement) could be either profitable or cause a financial strain depending on the scheme's benefits. For example, a lighter mortality in case of a pensioner is expensive as pension is paid longer.
- Similarly, the other risks include the actual investment return achieved and the salary experience.
- Another risk worthy of noting is the Asset / Liability mis-match.

Operational

- Possible poor Scheme administration e.g. incorrect payments to and from the scheme
- Other compliance issues
- Misappropriation of assets

Legislation

- The impact of future unknown changes to legislation.

For example

- Requirements to provide higher minimum benefits;
- Increases to existing benefits
- Winding Up requirements
- Political risks

[5]

(ii)

- Start by specifying the problem (e.g. reduce the financial risk) and analyse alternative benefit designs and contribution patterns to determine possible strategic decisions to mitigate the risks
- Use the following to develop the possible solutions:
 - Regular actuarial valuations to ensure the reserves held are sufficient to meet benefit promises and future contributions are set at satisfactory levels.
 - Using different actuarial models / funding methods and assessment of different valuation assumptions to gain greater understanding of their sensitivities.
- Asset/ Liability models to consider alternative investment options.
- Consider alternative definitions of current and future solvency levels.
- Monitor the experience and use the results to feedback into the problem specification and the solution stage of the control cycle
- Identify the causes of any departure from the targeted outcome from the model

[3]

(iii)

Financial

- Use a more conservative valuation basis and estimate the costs on various scenarios to understand the range of possible costs
- Insure death before retirement benefits if they cause a financial strain

Investment

- Use of ALM modelling
- Strategic asset allocation to match assets and liabilities
- Investment manager analysis/monitoring performance
- Purchase immediate annuities at retirement to transfer mortality and investment risk

Benefit Design

- Reduce the level of future benefits
For example
- Reduce the accrual rate
- Increase the pension age
- Change the definition of pensionable salary e.g. remove fluctuating emoluments
- Increased proportion of member contributions
- Switch to a defined contribution scheme or introduce a hybrid scheme

Operational

- Adopt good administrative procedures and systems
- Regular audits
- Use professional advisors and review regularly

[4]

[12 Marks]

Solution 4 :

(i)

SCR = 12%

Value of Assets = 75m

Value of Liabilities = 100m (160m – 60m)

Deficit = 25m

Value of 1% over total future service = 60m/12 = 5m

Amortisation = 25m/5m × 1% = 5%

RCR = 12% + 5% = 17% total

= 14% Company after 3% from members

[3]

(ii)

- Actuarial Value of Assets may be unduly conservative.
- If based on actual split Rs.75m becomes Rs. 80m.
- However depends on overall strength of basis and the assumptions used to value both assets and liabilities, which should be consistent.
- If value of past service liabilities only used then the funding method should be changed to PUM or AAM.
- Under the PUM method the SCR will be higher than 12% since average age is 45 vs. Entry Age of 35; could be around 15%.
- Why is current asset mix so far from benchmark, should this be taken into account in the assumptions for future investment return?
- This would impact upon the valuation result.
- Should the asset mix be changed to better match liabilities and minimise volatility of contribution rates.
- Valuation funding method only determines the pace at which the cost is met: pay less now and more later or vice versa.
- EAM could be maintained but reworked on a new entry age.
- Which if amortised and added to reworked SCR may result in little or no change to the RCR.
- However moving the Entry Age would change value of expected future contribution, thereby changing the past service deficit.

- What are the company's recruitment patterns, what is a realistic entry age, will the scheme remain open to new entrants.

[9]

[12 Marks]

Solution 5 :**(i) Reasons for analysing surplus**

Analysing surplus is part of the "Monitoring of experience" stage of the actuarial control cycle. It is one of the regular reviews that lead to an amendment of objectives and assumptions in the light of experience.

To provide an independent check on the valuation result.

To indicate those features of the past experience most likely to recur.

To measure the relative financial importance of departures from what was expected.

To provide useful background information to help when communicating to the client the reasons for changes in the funding level and contribution rate.

[3]

(ii) Reconciliation***Actives***

Expected value of accrual over the period 1 January 201X to 1 January 201X+3, at 1 January 201X+3, allowing for 3 years of ageing as there have been no changes to the membership, is

$$\begin{aligned} &= 1/60 * 3 * 10 * [1.04 \wedge 3] * [(1.04 / 1.055) \wedge (65 - 48)] * 18 \\ &= 7.9 \text{ m} \end{aligned}$$

Expected actuarial liability at 1 January 201X+3 is:

$$\begin{aligned} &50 * [1.055 \wedge 3] + 7.9 \\ &= 66.6\text{m} \end{aligned}$$

Actual actuarial liability at 1 January 201X+3 is 68.7m, so the loss is 2.1m.

Current pensioners

Expected actuarial liability as at 1 January 201X+3 is:

$$\begin{aligned} &12 * [1.055 \wedge 3] - [1 * 3 * [1.03 \wedge 1.5] * [1.055 \wedge 1.5]] \\ &= 10.7\text{m} \end{aligned}$$

Actual actuarial liability at 1 January 201X+3 is 11m, a loss of 0.3m.

Contributions

Expected accumulated value of contributions over the three years to cover the cost of benefits accruing (assuming contributions are based on expected cost of accrual with no membership changes) is 7.9m from above.

Actual contributions are zero, resulting in a loss of 7.9m on contributions.

Assets

The only cash flows over the period were pension payments so the expected value of assets at 1 January 201X+3 is:

$$= 90 * [1.055 ^ 3] - 1 * 3 * [1.03 ^ 1.5] * [1.055 ^ 1.5]$$

Actual assets are 86.7m as at 1 January 201X+3, hence there is a loss of 15.5m on assets.

Reconciliation

Surplus at 1 January 201X	20.0m
Interest on surplus $[20 \times (1.055 ^ 3 - 1)]$	3.5m
Actives	(2.1)m
Pensioners	(0.3)m
Contributions	(7.9)m
Assets	(15.5)m
Miscellaneous (<i>ie</i> unaccounted for in above)	0.3m
Surplus at 1 January 201X+3	(2.0)m

[12]

(iii) Salary experience investigation

There are two aspects to investigate – general increases and promotional / age-related increases.

These are difficult to distinguish in practice.

Need to use data for members present at both valuation dates ...

... otherwise you will be looking at the experience over two different populations and the answer may be false.

One method is to develop a table which compares for various age groups the average salary at this valuation and the average salary at the last valuation. Any increase is due to both general and promotional increases.

This can be compared with what was expected.

To analyse promotional increases separately you need to identify the global cost of living rises awarded each year over the inter-valuation period.

This is most easily done with the company's help.

Alternatively for each age group you could compare the average salary of all members at the last valuation with the average salary of all members at the current valuation. This should indicate the general increase in pay excluding promotional increases.

However, this figure can easily be distorted and should be treated only as a rough guide.

National salary inflation can also be a useful indicator.

Once the actual cost of living increases have been identified, this can be removed from the figures to identify the actual promotional increases ...

... and hence compare against expected promotional increases.

[8]

[23 Marks]

Solution 6 :

(i) The options can be categorised broadly as follows:

1. Transfer the assets and liabilities to a third party on a group basis. This third party may be:
 - Another pension scheme with the same sponsor
 - A central discontinuance fund operated on a national or perhaps an industry-wide basis.
2. Transfer funds to a third party on an individual basis. Either by:
 - Transferring funds to the beneficiary to extinguish the liability
 - Transferring funds to an insurance company to invest and provide a benefit
 - Purchasing guaranteed benefits with an insurance company.
3. Run the scheme as a closed fund.
 - The scheme continues without any further accrual of benefits. The scheme is operated as a closed fund with a gradual removal of liabilities.
 - A self-sufficiency approach may be adopted, using a prudent basis, a de-risked investment strategy and no further reliance on the sponsor.

[4]

(ii) Discontinuance valuation assumptions vs ongoing valuation assumptions

- The assumptions for a discontinuance valuation will depend on the approach being adopted for discontinuance.
- The approach may be dictated by legislation.

- The benefits may be different on discontinuance again depending upon the approach taken, *eg* the link with final salary could be broken.
- There is no future service to value.
- An ongoing valuation may allow for some discretionary increases to benefits (*eg* pensions in payment) at a higher level than in a discontinuance valuation.

Option (1)

Under this approach it may be that there is no difference between the discontinuance and ongoing valuation assumptions in particular if the third party is the sponsoring employer who will be able to guarantee benefits with future contributions.

However, even where there is a willingness to cover any future shortfall, the discontinuance valuation assumptions may be more prudent than the ongoing assumptions.

For example, the trustees of the receiving scheme may require a margin of prudence. This would help maintain a safety margin for the existing members.

Option (2)

With this approach a discontinuance valuation is influenced more significantly by the short term, *ie* current market conditions.

Assets are likely to be assessed at market value.

Winding-up expenses need to be included in the discontinuance valuation. These may be significant, *eg* independent trustee and actuarial fees.

If benefits are bought out, liabilities will be valued using “market value”, *ie* we must take into account the terms offered by insurance companies.

Insurance company terms will contain margins to allow for profit, expenses and also reinvestment and longevity risk.

The price of guaranteed deferred annuities would be based on the underlying investments, probably government-issued fixed-interest and index-linked bonds, which are likely to produce a lower return than shares.

Option (3)

The ongoing valuation of an open scheme is likely to use long-term assumptions that take into account the expected return from a portfolio of assets that will probably contain a significant proportion of equities.

In the long term these are expected to provide a better return than government bonds.

If the scheme is assumed to continue in a closed state, the valuation of the liabilities will need to reflect the expected future investment strategy.

So, if the scheme is expected to continue to run as a closed scheme, the assumptions may differ from those for an open scheme, and may be more prudent.

This is particularly the case if the scheme has been closed for some time, for example because the trustees may want to reduce their reliance on the strength of the sponsor

... or because the assumed investment return may be lower for a closed final salary scheme to reflect a more conservative investment policy.

[10]

(iii) Disadvantages of summarised data for the insurance company's actuary

The absence of such detailed data may mean the scheme cannot:

- produce a valuation result which is as accurate as possible
- allow the benefits to be valued accurately, *eg* a money purchase underpin
- enable individual membership data to be checked, *eg* reasonableness checks, cross-checks against previous years' data, reconciliations
- investigate the reasons for errors
- Analyse past experience in detail, perhaps leading to the choice of the most suitable assumptions.

[2]

[16 Marks]

Solution 7 :

(i) Factors to consider for a Scheme's actuary

- Equation of value
- Costing / profitability
- Long term bond return , average rate of valuation rate of return
- This, however, will depend on the legislative environment and custom and practice. Consider external impact, e.g. disclosure or accounting. competitive, existing insurance, industry standard or legislative conversion factors
- appropriate rate of discount to value the benefit In which case this should be reviewed periodically
- Scheme documentation/Trust Deed may require certain terms.
- Mortality assumptions need to be set, In theory, should consider the likely mortality rate of those who are likely to exercise the option Could assume that scheme will be selected against and that the option will only be exercised for those dependants in good health and/or members in poor health.

- In practice it may be that most people with dependants exercise the option and that no special allowance for mortality needs to be made.
- Age of member and dependant will be relevant to cost of surrender.
- Could use the actual age or an average figure.
- Need to decide a practical solution of strict accuracy of all the above points versus administration simplicity.
- Employer's objective. Do they want to encourage take up.
- Could also make allowance for additional administration and investment costs
- Need to consider to what extent, if at all, should include allowance for discretionary post-retirement benefits in conversion terms for example pension increases
- Fairness for the member and other beneficiaries in the Scheme i.e. to the extent the discretionary benefit may be expected for the member/dependant (past practice, competitive pressure etc.). These should be allowed for.

[8]

(ii) Restrictions

- Impose a limit on the amount of a member's pension which can be surrendered.
- It could be subject to satisfactory evidence of good health.
- Availability may be restricted to a specified period e.g. just before retirement, or at a particular event (marriage).
- Once elected, the decision could be irrevocable.
- May restrict the dependant by the nature of the relationship or age – perhaps
- Adjusting the conversion terms for large age differences if an average difference is assumed for conversion terms.

[3]

[11 Marks]
