Institute of Actuaries of India

Subject ST4 – Pension & Other Employee Benefits

October 2014 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 political, economic and fiscal viewpoints of the State will determine the precise roles that it will play. However, the roles are likely to fall within the following categories:

- provide benefits to some or all of the population
- educate or require education about the importance of providing for the future
- regulate to encourage or compel benefit provision by or on behalf of some of the population
- regulate bodies providing benefits, and those bodies with custody of
- funds, in an attempt to ensure security for promises made or expectations created.

In performing each of these roles, the State should also consider the whole picture to ensure consistency between the roles.

The state may provide direct provision by:

- paid regardless of income or based on need, ie means-tested
- flat-rate or related to an individual's salary
- subject to eligibility criteria, eg residency or contribution requirements.

The State may undertake educational initiatives itself. Alternatively, it may impose regulations as to the minimum levels of information to be disclosed to inform and educate benefit scheme members.

The State can encourage private-sector retirement benefit provision in a number of ways, eg financial incentives, tax incentive in contribution, investment income or/and in benefit payment

[3]

ii. **Advantages of mean tested benefit:**

- may be a cost-effective way to guarantee that everyone achieves a certain standard of living in retirement
- may be redistributive if taxes are raised from those with more wealth / income, and means tested benefits are then paid to those with little wealth/ income.

Disadvantages of mean tested benefit:

- People may be discouraged from providing for themselves
- may create a poverty trap whereby increases in a person's income (or assets) merely reduces the value of the State benefits
- may encourage people to squander existing wealth so that they meet the means test earlier rather than later
- it may be perceived as unfair to those who do provide for themselves and do not receive any State benefits, especially if the tax that pays for the benefits is marketed as a specific "contribution" for State benefit provision
- means tested benefits are not taken up by all who are entitled to them
- it may be regarded by some as degrading to human dignity to offer what amounts to charity.

[5]

iii. Advantages of offering a defined contribution scheme:

- Contribution rate is more stable and predictable over time.
- This can be seen as Government performing a role of direct provision and encouragement by the Government together.
- Individual may appreciate Governments contribution as it's a direct transfer to their account.
- This way they can target the needy as the Government contribution is for those who contribute upto Rs. 1000.
- The cost to Government may also be controlled both at contribution level and there is no defined benefit guarantee.
- Individuals may understand and appreciate the arrangement for its simplicity.
- The individual with other private means may also be attracted to this scheme because of the choice of funds available and less fund management charges.
- Individuals may view the arrangement as more secure since they are not exposed to the State changing the benefit formula (a risk for a defined benefit arrangement).
- There may be reduced administration from the State's viewpoint if provision can be through private companies (overseen by the State).

Disadvantages of offering a defined contribution scheme

- The benefits are not guaranteed, for example poor investment performance could lead to an insufficient pension for individuals.
- The investment performance be good till the accumulation period but the poor annuity rates may ultimately defeat the purpose of providing protection to the individuals.
- It requires that there are sufficient suitable investments available.
- Additional arrangements are needed if extra protection benefits are to be provided.
- Some of these disadvantages may lead the State to provide a minimum benefit amount.

[7]

iv. The risk profile of schemes can be affected by:

- Size (large / medium / small)
- Type (defined benefit / defined contribution / hybrid)
- Maturity (new / mature / closed)
- Growth (new members / no new members)
- Sponsors (single employer / multi-employer)
- Country operated in (developed / underdeveloped / single / multinational)
- Regulation operated under (none / lots).
- Covenant of employer
- Funding position

[2]
[17 Marks]

Solution 2:

i. Reasons why disclosure standards may be desirable

- Pension liabilities can form a significant portion of a company's total liabilities, without appropriate disclosure of information it can be difficult to ascertain the true financial position of the company, both currently and the likely future development.
- The actual cost of accrual can be very different from the contributions paid (which can be volatile) in a particular year and appropriate disclosure can help ensure that a realistic cost is disclosed.
- Appropriate disclosure can help the company's stakeholders, for example shareholders and potential shareholders understand the viability of the company.
- In a developing country there may be a lack of established practice and knowledgeable practitioners, therefore legislation is desirable. It may also ensure similar considerations are made by advisers.
- Legislation ensures uniformity of disclosure across companies both in terms of amount and types of information disclosed.
- Legislation can also ensure consistent treatment from year to year, again to avoid a false impression of the company's position being given.
- If information must be disclosed then it may encourage companies to act in a more appropriate way in terms of managing the scheme.
- Such legislation can aid the understanding of members and other beneficiaries regarding the security of their benefits.
- Legislation can ensure that the liabilities of important subgroups (eg directors) are recognised separately, this will be of interest to shareholders and employees.

[3]

ii. Main items that might be disclosed

- The value placed on assets – the approach to valuation may be prescribed, for example to be fair value. In addition the investment strategy and investment return achieved over the year.
- The market value of the assets (where this is different from above).
- The value placed on liabilities:
  - The funding method used, which may be prescribed. If this method uses a control period or entry age assumption then this should also be disclosed.
  - The key assumptions used, again these may be prescribed. The aim is usually to reflect a realistic position so a best estimate approach may be used. This might be such that each assumption individually should be best estimate, or as a whole the basis should be best estimate.
  - The valuation approach to calculating the discount rate.
- The scheme's funding level, and the change in the value of liabilities over the year.
- The treatment of surplus or deficit including how, and the time period over which, it will be amortised.
- The contributions paid over the year and whether they were in line with the actuary's recommendation.
- The standard contribution rate and the modified contribution rate for the next year together with payroll details and any additions, eg insurance premiums and expenses such that contributions can be estimated.
- The amount and value of director's liabilities and their pension costs over the next year.

- Details of any material changes to the scheme that will affect future costs, for example changes to the scheme design.
- Any changes made to the assumptions, funding method, approach to calculation compared to the calculations for the last set of accounts.
- Reconciliation of the movement between the previous surplus/deficit and the current surplus/deficit including details of actual contributions paid in the interim.

[4]

[7 Marks]

Solution 3:

i. Reasons of assessing the employer's covenant

- Shows the ability and willingness of the sponsor to pay sufficient contributions to ensure the benefits can be paid as they fall due
- Used to determine the key assumption and the level of required prudence1
- And the investment strategy
- And general risk tolerance level
- Affordability of future deficit funding plans
- Can be used as part of a process to obtain contingent asset protection

[2]

ii. Key issues that finance director will consider

- What is the employer's current financial position?
- What is the employer's expected future financial performance?
- Which assets and income streams could the pension scheme access?
- What is the employer's general attitude to supporting the Scheme?
- Can the Finance Director share the relevant information with the other trustees?
- Is he conflicted with a vested interest?
- Should the trustees request the information directly from the Employer
- Is independent advice from specialists needed
- Need to document an audit trail of how the covenant assessment will be made
- The assessment is made by the trustees as a whole not just the Finance Director
- Need to consider the financial data relative to the scheme funding level
- If the scheme is well funded the covenant is less of an issue
- Need to consider scheme ranking against other creditors

[4]

iii. Information from employer

- Details of the employer's current financial position
- What is the employer's expected future financial performance
- Company report and accounts
- Management accounts
- Projections of sales, profit, cashflow, debt etc.
- Details of general business outlook
- Details of what the future pension contributions the employer's cash flow can support

Other available information

- Financial metrics – financial statistics and accounting ratios
- Comparison with peer group
- Analysts' reports
- Implied market default risk
- Credit ratings
- Financial / Market forecasts for the Industry sector as a whole

[2]

iv. Trustees have a duty to ensure sufficient contributions are paid so that scheme benefits can be paid as they fall due

- For an ongoing pension scheme existence of deficit could be viewed as an unsecured debt on the sponsor
- This deficit will rank alongside other creditors of the sponsor If a pension scheme winds up there may be a deficit that will not be paid. The trustees will need to assess the security of accrued benefits and the differing priorities of various categories of members.
- To aid setting the general investment strategy and in particular how "safe" the backing assets need to be e.g. Government Securities.
- To aid setting a prudent valuation basis and in particular any adjustment needed to the discount rate to allow for the underlying risks
- To understand how much the employer can actually afford to pay and over what reasonable period the contribution schedule should extend.
- Relating the employer's ability to pay to their willingness to pay.
- Any trust deed & rules requirements
- Assessing the impact of any statutory minimum contributions.
- Allows consideration of alternatives to cash payments e.g. charge on company assets.
- Assessing trustee demands for earlier payments of contributions to make good any deficits.
- Trustee decisions to trigger wind up or forcing cessation of future benefit accruals.

[6]
[14 Marks]

Solution 4:
Managed Fund

- contributions are paid into the unitised fund
- the prices of unitised funds are directly linked to the value of the underlying assets
- funds available include various mixed funds and various sector funds
- investment risk is borne by benefit scheme (no guarantees)
- explicit expense charges
- surrender terms clear (except property funds where a delay may be imposed, and
- in cases where a large surrender causes a change in the method of unit pricing)
- to the extent that a scheme's outgo exceeds its income, units would need to be realised to pay benefits.

Deposit Administration:

- Deposit administration arrangements may not participate in the profits of the provider. Rates of interest are at the discretion of the provider.
- Contracts that offer a high guaranteed rate of interest are expected to provide a low bonus rate and vice versa. In the extreme, there may not be a guaranteed minimum rate.
- The guaranteed interest rate may depend on bond yields now or bond yields when you applied the money.
- Charges may or may not be explicit. Explicit charges are common – these may be expressed per scheme, per movement, per member etc. Surrender charges may be unattractive.
- Expenses and insurance costs may be deducted from contributions.
- Expenses may include a charge for other services, eg administration.
- Money is withdrawn to pay benefits.

With profit arrangements:

- the investment return payable is made up of a (typically low) guaranteed amount plus bonuses, which are determined at the provider's discretion based on its actual experience. This has the effect of smoothing investment returns over time.
- The provider may allow the sponsor to reduce contributions in lieu of paying a bonus.
- As there are some investment guarantees there may be some investment restrictions for the provider, ie a need to hold bonds.
- Expenses and life insurance costs may be loaded into the premium rates.
- Surrender terms may be unattractive.

[6 Marks]

Solution 5: (i)

Attained Age method

$$AASCR = \frac{\frac{(R-x)\times S}{A}\times\left(\frac{1+e}{1+i}\right)^{R-x}\times a'_R}{S\times a_{\overline{R-x}|}}$$

$$AAAL = \frac{(P+F)\times S}{A}\times\left(\frac{1+e}{1+i}\right)^{R-x}\times a'_R \;-\; SCR\times S\times a_{\overline{R-x}|}$$

Entry Age method

$$EASCR = \frac{\frac{(R-E)\times S}{A}\times\left(\frac{1+e}{1+i}\right)^{R-E}\times a'_R}{S\times a_{\overline{R-E}|}}$$

$$EAAL = \frac{(P+F)\times S}{A}\times\left(\frac{1+e}{1+i}\right)^{R-x}\times a'_R \;-\; SCR\times S\times a_{\overline{R-x}|}$$

Projected Unit method

$$PUAL = \frac{P\times S}{A}\times\left(\frac{1+e}{1+i}\right)^{R-x}\times a'_R$$

$$PUSCR = \frac{\frac{1\times S}{A}\times\left(\frac{1+e}{1+i}\right)^{R-x}\times a'_R}{S\times a_{\overline{1}|}}$$

Current Unit method

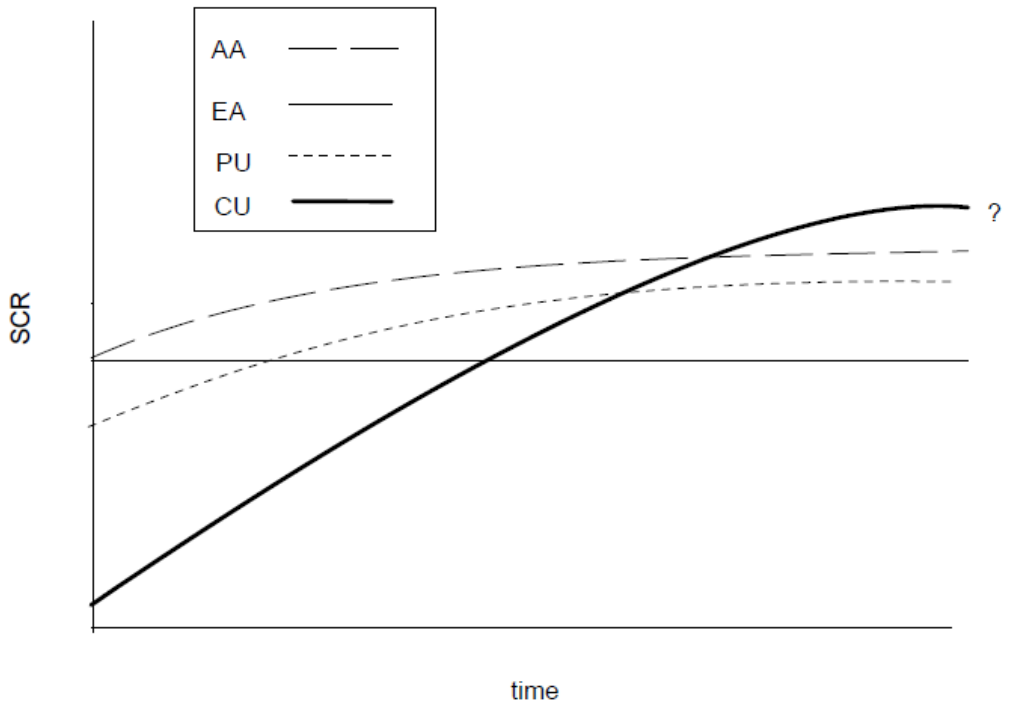
$$CUAL = \frac{P\times S}{A}\times\left(\frac{1}{1+i}\right)^{R-x}\times a'_R$$

$$CUSCR = \frac{\frac{1\times S\times(1+e)}{A}\times\left(\frac{1}{1+i}\right)^{R-x}\times a'_R \;+\; (CUAL\times e)}{S\times a_{\overline{1}|}}$$

[2]

(ii)

- It is sensible to start by drawing the EASCR because it is a prospective method (i.e. "driven" by is contribution rate) and we know that it is stable throughout.
- We can then plot the AASCR by noting its behavior relative to the EASCR as the membership ages and eventually stabilises above it. Note that the exact shape of the curve will depend on how the membership develops – it might be concave or convex before flattening out – this is not too important.
- We can then draw the PUSCR below the AASCR. We also know that the PUSCR starts below the EASCR and stabilises above it.
- We can draw the CUSCR by noting that it starts below the PUSCR and stabilises above it. We would expect it to take longer to stabilise due to the additional requirement that the past service is stable too. We do not know where its final position will be relative to the AASCR (and have drawn it stabilizing above it in the graph above).



[4]
[6 Marks]

Solution 6:

i. For all approaches, assets taken at market value.

Asset-based discount rate

An implied market discount rate is determined for each asset class

Could use gross redemption yield for bonds i.e. between 8.7% and 8.2% p.a. depending on term of bonds held

For equities, more judgement needed. Assuming inflation of 7.5% p.a., historic real equity returns might suggest 13.5% p.a.

A weighted average of the individual discount rates based on the proportions invested is used to discount the liabilities that would give .8 × 13.5 + .2 × 8.5 say i.e. ~ 12.5% p.a.

Alternatively a notional portfolio in

tended to match the liabilities could be used to determine the weighted average of the individual discount rates, perhaps more like .6 × 13.5 + .4 × 8.5 i.e. ~11.5%p.a.

Mark to market approach

This is a "replicating portfolio" approach which compares to a portfolio of assets that closely replicates the duration and risk of the liability measure

For the liabilities there is an implicit assumption that a set of bonds can be found to match the liability cash flows e.g. pensions with fixed increases, pensions with inflation linked increases

From each set of bonds it is possible to derive a yield curve, which can be applied to the corresponding projected benefits to determine a value that is consistent with the value of the replicating portfolio

The appropriate yield curves are generally those relating to nominal government bonds and inflation linked government bonds

Yield curve here curves upwards, suggesting a lower discount rate for pensioners (towards 8.2%) than non-pensioners (8.7%).In practice an "average" yield may be used as the discount rate i.e. maybe value all liabilities using ~ 8.5% per annum

Bond yield plus risk premium

This is also a "replicating portfolio approach" where for the liabilities the discount rates are based on bond yields i.e. 8.2% to 8.7% or average as under mark to market ~ 8.5% p.a. but then increased to take account of the returns expected on other asset classes often referred to as an "equity risk premium"

Historic data could be used to argue for (6.0 − 0.9) ~ 5% p.a. (1946 to date), the level of the risk premium would depend on the actual assets held so apply the .8/.2 weightings to give discount rate in range ~12%

It may be constant over time or vary depending on the assessment of market conditions .

For asset-based discount rate and bond yield plus risk premium approaches must allow for the degree of prudence to be incorporated any equity "out performance" is not guaranteed so the scheme is still reliant on the strength of the employer covenant.

[12]

ii. Methods for adjusting mortality tables

Generally standard mortality rates taken from a standard table are used, which may be adjusted to fit the experience of the scheme. Alternatively, since this is a large scheme, mortality rates may be taken from scheme-specific mortality rates.

In both cases, the tables need to be projected to allow for future improvements and experience expected in future.
There are number of possible methods by which mortality can be projected into future

Process based projections – these attempt to model trends in causes of death

Extrapolative methods – historical trends in mortality are projected into the future

Cohort Effect - an allowance for mortality improvements say using patterns by year of birth or "cohort"

A simplistic approach to allowing for improvements in mortality is to allow for a pre-determined reduction in the mortality rate

Stochastic approach – due to increasing uncertainty, stochastic approach can be used, for example allowing for trends, the time taken for the improvements to wear off can be set as a random variable.

[6]

iii. Advantages of the strategy

- Investment risk is only retained for as long as is needed
- Gradually moving to a lower risk strategy
- Also more practical / less likely to affect market prices
- As and when the Scheme can afford to do so
- Potentially reducing need for regular investment risk reviews
- Can lock into a stronger funding position
- With good investment return 'locked in' and not lost again in the future which turns market volatility to the Scheme's advantage
- Likelihood of future cash calls / dependency on the sponsor is reduced
- Strategy can be aligned to other risk management opportunities e.g. buying annuities

Disadvantages

- Any allowance in the valuation basis for equity outperformance will need to reduce over time due to the revised asset mix
- Would increase the measure of liabilities and may in turn require higher contributions
- May require equities to be sold when their prices are low and/or bonds purchased at times their prices are high (i.e. sub-optimal returns)
- Lose opportunity for future good equity performance
- And prevents any re-risking opportunities where risk is increased to meet certain targets
- If already in deficit, the highest investment risk is being taken when scheme is worst funded.

[5]

[23 Marks]

Solution 7:

i. PV of the benefits under the Defined Benefit scheme are;

= 40 x 0.02 x S x v^{40} x 15 at a rate of (1.05/1.0175)-1 = 3.2%

= 40 x .02 x S x 0.28367 x 15

= 3.404S

Let Mr. Alpha's contribution to be c%

PV of contributions (including Mr Alpha's share)

= S [(c+5%) x $\bar{a}_{\overline{40|}}$ + v^5 x 2% x $\bar{a}_{\overline{35|}}$ + v^{15} x 2% x $\bar{a}_{\overline{25|}}$ + v^{25} x 3% x $\bar{a}_{\overline{15|}}$] at 3.2%

= S [c x $\bar{a}_{\overline{40|}}$ + 5% x $\bar{a}_{\overline{40|}}$ + v^5 x 2% x $\bar{a}_{\overline{35|}}$ + v^{15} x 2% x $\bar{a}_{\overline{25|}}$ + v^{25} x 3% x $\bar{a}_{\overline{15|}}$]

= S[c x 22.742 + .05 x 22.742 + 0.84528 x 0.02 x 21.205 + 0.62345 x 0.02 x 17.302 + 0.455 x 0.03 x 11.954]

= S [22.742 c + 1.8744]

PV of MP contributions = PV of the DB benefit

3.404 S = S [22.742c+1.8744]

22.742 c = 3.404 – 1.8744

c = 1.5296/22.742

c = 6.73%

Mr. Alpha will have to contribute 6.73% to the money purchase scheme to maintain the same level of benefits at retirement as the Defined benefit scheme. **[7]**

ii. Forms of Guarantees

There are several forms of guarantees that Infinity Limited can provide to the members. These fall into two categories;

- Investment returns – e.g. the members' accounts will earn at least 3% investment return per annum
- Benefits – e.g. that benefits will not be less than for example 2% of final salary for each year of service

The extent of the guarantees will vary; often they are a minimal underpin to protect members from extreme adverse experience. **[2]**

[9 Marks]

Solution 8: Risks

i. Volatile Income or risk of reducing capital if resident chooses to take fixed income every year.

It could potentially reduce to zero funds before death leaving them dependent on the state at the end of his/her life

Depending on the level of financial sophistication, residents with a high level of understanding are more likely to feel confident in investing their own DC funds.

Those with small funds may face prohibitively large management charges due to admin costs of regular drawdown

May not provide dependents with sufficient fund if resident pre-decease's

[3]

ii. Government Options

- Change back requirement so residents only have to use a proportion of their DC funds to purchase an annuity
- Increase the age (65) from which members must purchase an annuity
- Encourage insurers to increase flexibility in their annuity products through legislation or voluntary participation e.g. variation in pension payments, share in the investment/risk allow more choice

- Allow residents to purchase annuities in phases this may appeal to those who want to continue working part time/semi-retire
- Encourage insurers to reduce cost of annuities
    - E.g. Tax Breaks
    - Regulating expense loadings to drive efficiency
    - Reducing barriers to entering the market or increasing competition
- Introduce a government run annuity provider which can
    - Offer flexibility

- Insure at lower cost due to government backing so no need to build in extra reserves

- Education to tackle the perception that annuities are expensive **[7]**

[10 Marks]

Solution 9:

(i). The scheme could be insured, so the employer pays the insurance premiums

Alternatively, the scheme could be self-insured so the employer pays the cost of claims paid each year

Alternatively, a reserve could be established the liability could be deemed to be accruing over the prospective working lifetime to retirement or possibly to the expected date of death

A calculation of the type N/NS x total life assurance benefit could be conducted for each member of the scheme and the actuarial value of the possible payment of this accrued liability using actuarial funding assumptions could be determined.

[3]

(ii) The insurance premiums will be calculated allowing for:

The expected risk cost over the following year (if based on a re-current single premium approach)

The expected risk cost spread over a given period e.g. 3 years (if based on a 'unit rate' approach with a guaranteed rate period)

The expected risk cost is the life assurance benefit multiplied by a suitable mortality rate with the mortality rate either based on experience rating or a standard rate based on occupation and geographic location

The insurance premium will also include an expense loading and an insurance company profit loading

[5]

[8 Marks]

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