Institute of Actuaries of India

Subject ST4 – Pensions and Other Employee Benefits

November 2008 Examination

7th November 208

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

Question 1

a) **AAM SCR**:

the present value of all benefits that will accrue to current active members after the valuation date, by reference to service after that date and projected final earnings

divided by

the present value of total projected earnings for the current active members throughout their expected future membership

AAM AL:

the present value of total benefits based on projected final earnings for members in service minus the value of the SCR multiplied by the present value of total projected earnings for all members throughout their expected future membership

or

the present value of all benefits accrued at the valuation date, based on projected earnings for members in service

EA SCR:

the present value of all future benefits for a member joining at the assumed entry age, by reference to project earnings

divided by

the present value of total projected earnings for that member throughout his/her expected membership

EA AL:

the present value of total benefits based on projected final earnings for members in service minus the value of the SCR multiplied by the present value of total projected earnings for all members throughout their expected future membership

PUM SCR:

the present value of all benefits that will accrue in the one year following the valuation date, by reference to service in that year and projected final earnings

divided by

the present value of all members' earnings in that year

PUM AL:

the present value of all benefits accrued at the valuation date, based on projected earnings for members in service

CUM SCR:

the present value of all benefits that will accrue in the year following the valuation date by reference to service in that year and projected earnings at the end of that year plus, the present value of all benefits accrued at the valuation date in respect of members in service, multiplied by the excess of the projected percentage increase in earnings over the next year over any early leaver revaluation assumed.

divided by

the present value of all members' earnings in that year

CUM AL:

the present value of all benefits accrued at the valuation date, based on current earnings for members in service

b) I)

- The method producing the largest AL will be the more secure (assuming assets back that liability 100%).

- AL EA > AL AAM providing the assumed entry age is lower then the weighted average age of the membership and the discount rate>salary growth
- AL AAM = AL PUM
- AL PUM > AL CUM, assuming that salary growth assumption is greater than the rate of any early leaver revaluation rate assumed under the CUM.

with those parameters and assumptions

EL>AAM=PUM>CUM

ii)

- need to assume salary growth is less than the discount rate
- and, salary growth greater than any early leaver revaluation rate

- factors to consider are:

age, future service, benefit revaluation and past service and so not always a definite answer.

In general,

- SCR AAM>EA if the average age is greater than the assumed entry age
- SCR AAM>PUM if the average future period to NRA is greater than one year
- SCR PUM>CUM if in general there is lower past service

(Total 10 Marks)

Question 2

- Define a wind up of a scheme:
  Winding up is the process of terminating a pension scheme, by removing both the assets and liabilities of the scheme.
- Will occur if the Trustee decide it's the best course of action for the provision of benefits or,
- The sponsoring employer does not want to continue the scheme and would like to remove its future obligations to the scheme
- If a company becomes insolvent the scheme may be required to be wound up (either dictated by legislation and/or the Trust Deed)
- Once a wind up is triggered there may be further contributions paid by the sponsoring employer
- The process of conducting a wind up should be dictated by a combination of the Trust deed as well as governing legislation.

- Need to decide if legislation should define the right of the members as a member:
  - rights could be described as;
  a) the member left the scheme voluntarily
  b) they remained in the scheme until retirement (with no further accrual of benefits)
  c) they remained in the scheme until retirement continue accrual of

benefits

- It would be common to express the minimum level of rights as a).

- Need to consider that a scheme will have active members, deferreds and pensioners/dependents in payment. For pensioners one must consider if only past payments paid are considered a right or future expected payments too.

- In defining minimum rights one needs to consider:
    - Future inflation protection. It would be expected that future salary growth would not be considered a right although any statutory early leaver revaluation or pension increases once in payment would be considered as a right.
    - One would not usually consider any future discretionary benefits that the Trustees may have granted as right.
    - Already granted discretionary benefits may be classed as a right.
    - Contributions paid my members may be considered as a right and that the value of benefits would be at least the value of the contributions paid by the member.

- Defining the minimum rights will dictate the base minimum liabilities the scheme has on wind up. However that is not necessarily the level of benefits the members will actually receive. Adequacy of funds available needs to be considered.

- Legislation can play a part in the following areas with respect of determining the actual level of benefits a member may receive once assets are considered.
    - Prescribing the basis and method of calculation of the liabilities to compare against the assets.
    - Should be a solvency basis assuming market value of assets and assumptions/method of liability of calculation that is consistent with this.
    - Examples: if trying to reflect the cost of securing the liabilities with annuities from an insurance company, another example is the use of a minimum funding basis (if one exists in the country's legislation)
    - Prescribing what the responsibility of the employer is if there is a shortfall in the assets as compared to the value of the minimum level of benefit rights.

- A government can prescribe if that shortfall should be funded immediately before the wind up can be completed and if so, what amount.
- One could differentiate between an insolvent employer and an ongoing employer (choosing to wind up the scheme).

- Legislation can address what happens if there is a shortfall in assets.
  - which types of benefits and beneficiaries should be reduced
  - in what order they should be reduced

  - for example:
    - expenses
    - pensions in payment
    - member contributions
    - early leaver benefits (deferreds and actives)
    - other remaining benefits

- Legislation can address what happens if there are surplus assets
  - Whether funds should return to the employer
  - What would be the tax treatment of that
  - Whether benefit enhancements should be given above the minimum level to beneficiaries, before funds return to the employer
  - Trustees will have to decide how to allocate the surplus between different classes of beneficiaries. Legislation may be able to help in this area. Expectations of the beneficiaries can help to decide.
- Communication to beneficiaries is crucial during the wind up process
  - legislation can help make that process happen
  - legislate timings of such communications
  - legislate the minimum content of these communications
- Finally, once the level of funds/benefits available for members determined one can legislate for the methods in which these liabilities can be discharged.

- Examples include:
  - Annuities secured with an insurance company
  - Transfer of assets and liabilities to a new scheme of the same employer

- Different conditions may exist if the new scheme is defined contribution in nature against an existing alternative defined benefit (so as to protect the security of benefits for both sets of members)
- Individual transfer of a members share into their new employer's scheme or an individual pension plan
- Transfer of assets and liabilities to a central discontinuance fund

(Total 15 Marks)

Question 3

a)

a. It forms part of the actuarial control cycle that leads to a review of the assumptions used in light of actual experience
b. Highlights the impact of actions taken between valuations on the finances of the scheme e.g. benefit improvements, significant events (such as a merger/disposal)
c. Provides an independent check on the valuation
d. May be required by guidance notes to include an analysis as part of the valuation report
e. Useful communication tool to show recipients of the valuation the financial importance of certain assumptions and experience being different from that assumed

b)

- The primary source of surplus/deficit is due to differences between the assumptions made and the actual experience.
- Surplus/deficit rolled forward from last valuation with interest
- Investment return earned on assets different from that assumed in the last valuation discount rate.
  - Surplus created if actual return higher
- Salary increases for a salary related defined benefit scheme given in the inter valuation period different from assumed in the last valuation
  - Need to measure those in last valuation and this valuation
  - Higher salary growth than assumed creates a deficit
- Promotional increases
- General price inflation
  - Affect inflation linked pension increases
  - Revaluation of deferred pensions
- Pension increases given in payment more than that assumed in the last valuation

    - Inflationary increases greater than assumed rate of inflation assumed will create a deficit item
    - Discretionary increases given
- Benefit improvements made to past benefits accrued which were not funded at the time will be a source of deficit
    - Legislative changes
    - Trustee granted
- If pensions secured by annuities at retirement the actual cost of those annuities compared to that assumed.
    - A source of surplus if annuity rates are lower than what assumed in the last valuation for future retirements
- Amount of pension commuted by retirees
- Pre-retirement mortality
- Post-retirement mortality
    - Pensioners and/or dependents
- Ill health retirement experience
- Withdrawal from service
- Timing of retirement (early/late retirements)
- Proportion married
- Contributions paid different from that expected
- Contributions paid different from the service cost of membership in the intervaluation period due to different demographic profile (e.g. due to new entrants)
- Change in funding method at this valuation
- Change of assumptions at this valuation

c)

- Objective to analyse the salary increases given versus the assumption
- Salary experience can be analysed in two parts: general increases and promotional increases
- Difficult to separate these in practice
- May want to analyse by age as well
- Data required:
    - Active members in both last valuation and this valuation
    - Otherwise the exercise will be distorted as looking at two populations
    - Age of the member
    - Pensionable salary at both valuations
- Group the membership into an age related table within which one compares the average salary of that homogenous group from last valuation and this valuation. This incorporates general and promotional increases.

- One could use period of employment as well instead of age, if appropriate.
- Need to ensure there is credible data in each group for the analysis to be meaningful.
- The increases are compared to the assumption made
- Can ask the company for the general inflationary increases that were given in their salary rounds for each intervaluation year.
- This can be compared to the general increase assumption and the remainder would be due to promotional increases
- Which can be compared against the assumption
- A more general method to analyse general increases is to compare average salary for each age group using all members at each valuation (rather than those just in both valuations)
- This alternative approach is a rough guide only
- One needs to consider the definition of pensionable salary, in particular if there is an offset.
- One should separate the change in that offset as well, if the salary increase assumption is applied to pensionable salary rather than salary before offset.
- One will then need rework the data and separate out the changes to the offset compared to the assumption.

(Total 15 Marks)

Question 4

a)

- General considerations
    - Review what is mentioned in the Trust Deed and Rules
    - Are there any restrictions in the way the Trustees can invest in the TD & Rules
    - Are there any regulatory restrictions - either prescribed allocations or limits, asset classes permitted
    - Risk attitude of the Trustees
    - Risk tolerances of the sponsor, ie can they afford to make up shortfall if assets underperform?

- Nature of the liabilities
    - What are the plan provisions?
        - Are salary, revaluation in deferment, pension increases
        - Related to an index
        - Fixed increases

- Duration of liabilities

  - What is the membership profile, how close are people to retirement?
  - Younger the membership / longer the duration and hence
    - there is a lower cashflow requirement
    - greater opportunity for increased risk as the term to benefit from potential better returns is longer

- Size of fund
  - The scheme's assets will grow very rapidly as it is a new scheme and contributions will be far greater than expected outgo
    - However, need to consider the membership profile and also whether past company service is being included for pensionable service, and how significant is that amount of service
    - This means Trustees can invest in less liquid, less marketable assets
    - Trustee should consider insurance to cover large unexpected one-off outgos – such as for death in service lump sum

- Surplus/deficit
  - Only an issue for the new scheme if significant past service is to be credited at the start of the scheme, which is not being funded.
  - Trustees may consider investing so the initial deficit is "matched" so it does not increase over time unexpectedly.

- Nature of Assets
  - Comparison and appropriateness of each main asset class permitted
  - In terms of:
    - Volatility
    - Marketability/Liquidity
    - Tax treatment
    - Security
    - Cashflow
    - Expense
    - Term

- Trustees could have the actuary perform an asset liability study to test their tolerance for risk, meeting expected cashflows.

- Trustees need to define risk for their circumstance

  - For a new scheme, one definition of risk may be to ensure that the volatility in future contribution requirements as a result of deficits is minimised
- Trustee should consider that diversification is desirable
  - By asset class
  - By geography of assets (if permitted)

- When formulating a strategy, Trustee should consider how they will monitor performance against the strategy
  - Introduce benchmark indicators
  - Ensure there is a defined frequency of monitoring performance

- In the circumstance of the new scheme; a high proportion of equities would be suitable as there are less cashflow needs, there is a longer duration of liabilities and so short term volatility is less of a concern

b)

- Advantages
  - Employer elimination of longevity risk in retirement
  - Reduced inflationary risk for pension increases
  - Elimination of administration cost of paying and communicating with the pensioners
  - Removes the investment risk
- Disadvantage
  - Requirement for large cashflows when purchasing annuities
  - Paying insurance company for guarantee, insurer's profit and expenses and so in theory more expensive and so greater funding required
  - No guarantee of pensioners being looked after / administration quality
  - Pensioners may not benefit from future increases in benefit (if the policies are in the name of the pensioner)
  - The scheme does not benefit from any experience gains (inflation/mortality)
  - Scheme exposed to changing terms of annuities which change cost and can create a source of deficit
  - If in the name of the Trustees, data reconciliation more complex to ensure scheme and insurer knows who exists and benefits being paid.
  - An issue if winding up, want to distribute surplus / implement discretionary increases and where benefits only partly insured

(Total 11 Marks)

Solution 5

The scheme could be insured, so the employer pays the insurance premiums, possibly with some rebate if a profit sharing arrangement is used.

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 so that the expected death benefit could be calculated 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. In other words, for each active member the sum assured is multiplied by a temporary assurance factor and then ratioed by actual service to potential service (either to death or retirement)

The difference in the available fund compared to the accrued liability could then be spread to form part of next year's contribution. In other words, each year the reserve is increased by contributions and investment returns and reduced by any death benefits paid. The resultant amount is then simply compared with the reserve calculated as at the end of the year – any surplus or deficit would then be spread.

The future service cost could be calculated by considering the next year's accrual assessed on a basis consistent with the past service calculation (as mentioned above) so that the actuarial value of the possible payment of this liability at any time in the future could be determined using Projected Unit method. Credit can be given if the future service cost is calculated using Attained age method as well.
An alternative approach to the solution would be:
The insurance premiums will be calculated allowing for:

- o The expected risk cost over the following year (if based on a re-current single premium approach)
- o Or 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 insurance 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 expense and profit loading of an insurance company.

On practical grounds the insurance premium is usually quoted at the start of the year and then reviewed following the year end to allow for membership changes over the year.

(Total 7 Marks)

Solution 6

i) Suitability of wage inflation index-linked, mortality-linked bonds compared with CPI index-linked annuities.

Advantages of Bonds:

- if the individual wants to maintain his/her standard of living then linking to wage inflation is more likely to do this than price inflation (depending on how the indices are constructed), & vice versa as a disadvantage if the individual only wants to meet the same cost of living

- the bond is likely to be tradable which means that the individual can cash it in which will be nigh impossible with an annuity (because it is not a traded asset and mortality selection will prevent decent surrender values)

- the stream of income is maintained after the policyholder's early death (which may be important e.g. if he/she supports a family or there is a liability which is being paid off)

- there are probably lower costs associated with the bond compared with the annuity (e.g. at the very least the insurance company needs to allow for the cost of administration on the death of the policyholder)

- bonds are more secure (unless the government underwrites the insurance industry)

Dis-advantages of Bonds:

- it is unlikely that the individual will live precisely the average life-span and therefore the income stream from the bonds does not match the individual's requirements for a personal income -this means that, to ensure a reasonable chance of sufficient income in later retirement, the individual needs to over-invest. This is another way of describing what is often called "mortality drag".

- the same applied in respect of contingent beneficiaries e.g. spouse

- the insurance company annuity can be designed to meet the individuals requirements e.g. with respect to dependants pensions or impaired lives

- competition may keep the price of annuities relatively low

ii) Suitability

equities ("+" is an advantage of the bonds, "–" is a disadvantage)

\+ providing there is a material correlation between wage and price inflation, the bonds will match the liabilities much better than equities

\+ the bonds will entail lower management costs (if they are purchased and held instead of traded)

\+ in some countries, schemes are required to hold a certain proportion of assets in government debt

– if the scheme is in surplus then it is regarded as sensible to invest the surplus to closely match the liabilities.

– if there is any likelihood of benefit improvements if the scheme is overfunded and there are trustees then equity investment may increase the chances of this

– the corporate management may prefer equity investment (e.g. because it helps reduce disclosed cost if this is based on "expected value")

\+ maybe a greater risk of default for equities.

(Total 14 Marks)

Solution 7

The interested parties involved are – the sponsoring employer, members and their dependants, government and regulatory authorities.

The preferences of the sponsoring employer are likely to include:

- Predictable or stable cost in future
- Attract and retain suitable staff
- Acceptable level of cost
- Provide competitive benefits by the standard of the employer's industry
- Avoid future moral obligations to former employees
- Simplicity of administration
- Tax efficiency

The preferences of members and their members include:

- o Providing a reasonable level of income in retirement and financial protection to dependants on death before/after retirement
- o Affordability whilst in employment
- o Adequate information on which to base decisions on how much to contribute, planning for retirement etc.,
- o Flexibility of scheme benefits

The preferences of government/regulators include:

- o Encourage appropriate levels and forms of provision
- o Ensure adequate levels of provision
- o Ensure secure provision

Risks:

There is uncertainty for the member over the level of benefits, which may be less valuable than they expected for a number of reasons:

- o Not enough money was put in the first place
- o Investment returns were lower than expected
- o Annuity purchase terms were worse than expected – due to lower interest rates and increased life expectancy
- o Impact of inflation on purchasing power was not understood

Whilst most of the risks that are borne by the employer in a Defined benefit (DB) scheme are transferred to the member for a Defined Contribution (DC) Scheme, there may be a knock-on impact on the employer if members can't afford to retire or get much lower benefits than expected.

Design options and process

Various actuarial models can be considered to come up with a design/financing options.

If company are looking to target level of benefits, use models which illustrate the level of member and employer contributions needed based on appropriate assumptions.

Similarly, if the level of contribution is specified in advance, we can use these models to project the benefits that are likely to emerge.

Actuarial input is necessary in setting the assumptions for use in these models. For example – investment return, inflation, salary growth and annuity purchase prices.

Can test the sensitivity of the required contributions/expected benefits to changes in the assumptions.

Stochastic modeling can also help illustrate the potential variability of the benefits which will emerge.

Specific DC design issues which need to be addressed:

- Eligibility criteria e.g. age, period of employment, type of work, hours worked
- Retirement age – i.e. for DC, age at which employer contributions stop
- Split of member/employer contributions
- Will member contributions be the same for all members?
- Will contributions (member and/or employer) be flat or age/service related?
- Will employer match optional member contributions (to a specified level)?
- How will expenses be met – from funds or by employer?
- Interaction with state benefits (if any)?
- What options will be offered?
- How does target benefits compare with existing scheme?

The actuarial models described can also show the impact on the employer cost over time due to any age/service related scales and contribution matching.

Given that investment return directly affects the level of members' funds/benefits for DC; actuarial advice will also be valuable in determining which investment options are to be offered to members.

Investment issues which need to be considered are:

- The risk/return balance
- Tax efficiency
- Expected level of income/capital
- Level of management expense
- Range of options to be offered to members

- What default investment options are offered for members who don't make a decision

Members may be able to choose form of benefits:

- Amount taken as cash (tax-free) and pension
- Whether dependant's pension is purchased on retirement
- Level of pension increases

Advice may be appropriate on any constraints imposed by legislation or the sponsoring employer on these options.

Should members be offered the facility to secure pension within the scheme? If so, actuarial advice is needed on appropriate terms. Need to consider what level of non-retirement benefits will be provided.

Ongoing Monitoring

Need to provide members with information about their entitlements:

- To ensure they make adequate provision
- To ensure members understand the risks they are taken
- To manage members' expectations

Also enables the employer to check that their objectives are being met.

- In particular, are funds on target to deliver original benefit targets?
- Will members be able to afford to retire at the age at which the employer wishes them to do so?

Also monitor provider to ensure competitive

Items to be disclosed include:

- Current funds
- Levels of contribution
- Projected benefits on one or more sets of assumptions
- The assumptions used, including any benefit options
- Impact of inflation on purchasing power of funds
- Annuity conversion terms where appropriate

These items may be required on commencement, annually and on leaving

service etc.,

Legislative requirements/professional guidance may specify frequency and contents of disclosure, specify the range of assumptions to be used and require formal ‘valuations’ to check project benefits won’t exceed limits.

(Total 28 Marks)

[Total 100 Marks]

*******************END******************