DP-RC Model Solutions
Fall 2012

1. **Learning Objectives:**

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

7. The candidate will be able to analyze data for quality and appropriateness.

Learning Outcomes:

(6a) Evaluating actual experience, including comparisons to assumptions.

(6b) Adjust current assumptions, given past experience and future expectations in trends.

(6c) Evaluate appropriateness of current assumptions given the purpose.

(7a) Assess data quality.

(7b) Identify data needed.

(7c) Make appropriate assumptions where data cannot be provided.

Sources:

R-D130-09: ASOP 23 – Data Quality

R-D613-11: CIA General Standards 1000-1800– Revised , February 2011

R-D127-09: ASOP 6

Yamamoto Chapter 9

Commentary on Question:

In this question, candidates were asked to demonstrate that they understood and could identify the data elements required to prepare an actuarial valuation for a post retirement benefit plan and demonstrate their knowledge on data quality and the process for developing per capita claims cost experience for assumption purposes.

1. Continued

The well prepared candidate would have been able to outline how he/she would review the data to ensure its quality and appropriateness for a valuation. In addition, the well-prepared candidate would be able to outline the claims development process.

Solution:

(a) Identify the data elements needed to complete the January 1, 2013 actuarial valuation, including the development of the per capita claims cost assumption.

Commentary on Question:
This was a straightforward list-type question. Candidates generally did well on this section, as long as they noticed that the question was about the retiree health plan, and not the pension plan. For the first portion of part (a), credit was given for pension plan data elements listed, if they are also retiree health data elements. A good paper would have listed the important points – who data is needed for, the fact that the status of each participant is needed – in addition to listing the elements needed. For the second portion of part (a), the list we were expecting to see was sometimes embedded in the response to part (b), and credit was given in part (a) in that case. Here again, a good paper would have listed the important points – that actual claims and exposure data should be collected – in addition to listing the details of the claims/exposure to be collected (splits by age, gender, etc.)

The actuary should collect sufficient census data to make a reasonable estimate of the obligation:

- Need data on all current participants
- May need data on potential participants
- Status – active, retired, spouse, survivor of participant
- Age or date of birth
- Service or date of hire
- Gender
- Spouse date of birth
- Spouse gender
- Dependent date of birth
- Dependent gender

If pension data is provided, consider the appropriateness for use in the retiree health valuation, and make appropriate adjustments.

The actuary should collect sufficient data to calculate initial benefit costs for estimating the future health care obligations:

- Actual claims experience for the plan
- Exposure data

1. Continued

- Split by retiree vs. spouse vs. survivor
- Split by healthy vs. disabled
- Split by gender
- Split by age

(b) Describe the process and the considerations:

(i) To ensure data quality.

(ii) To determine the per capita claims cost assumption.

To ensure data quality, the actuary should consider:

- ASOP 23 Data Quality
- The scope of the assignment and the intended use of the data
- Is the data appropriate
- Is the data comprehensive
- Is the data reasonable and consistent
- Are there any material limitations of the data
- Cost and feasibility of obtaining additional data in a reasonable time frame
- Does the benefit gained from alternative data outweigh the time and/or cost to collect it

The actuary should document:

- Is the data of sufficient quality for the analysis
- The data requires enhancement before the analysis can be performed, and it is practical to wait for the enhancement
- Assumptions or adjustments can be made such that the data can be used
- If the data is so inadequate that the analysis cannot be performed
- The process followed to evaluate the data, including assumptions or adjustments made

The actuary should disclose the process followed when issuing communications about the analysis.

The process for determining the per capita claims cost assumption is:

- Quantifying aggregate claims costs
  - Paid claims- usually get this
  - Incurred claims – best to use this
  - If incurred claims not available, may need to adjust paid claims
    - Simplified factor
    - Sophisticated lag analysis
- Quantifying a measure of exposure to risk (count of participants eligible for the plan during the claims period)

1. Continued

- Applying information from normative databases and/or premium rates if appropriate

To determine the per capita claims cost assumption, the actuary should consider:

- ASOP 6 Measuring Retiree Group Benefit Obligations
- Using multiple claims experience periods
- Credibility of plan experience
- Use of premium rates
- Impact of Medicare and other offsets
- Age-specific claims rates
- Adjustment for plan design changes
- Adjustment for administrative practices
- Adjustment for large individual claims
- Adjustment for trend
- Increases due to health care utilization, technology, or cost-shifting
- Use of different trends for hospital, professional, drugs, etc.
- Relationship of health care expenditures to GDP

The actuary should document the process followed with sufficient clarity for another qualified actuary to make an appraisal of the reasonableness of the work.

2. Learning Objectives:

8. The candidate will be able to evaluate the actuarial considerations in plan options and administration.

Sources:
"Embedded Options and Pension Plans" study note pp. 1-17

Commentary on Question:
In this question, candidates were asked to demonstrate their understanding of the features of embedded options in pension plans.

A well-prepared candidate would have been able to explain how the two categories of "embedded options" differ from one another, and articulate how the embedded options work under various types of retirement programs.

In addition, a successful candidate should be able to analyze (qualitatively and quantitatively) the financial implications of introducing an embedded option in a pension plan (e.g. introducing a post-retirement indexation minimum).

Solution:

(a) Describe the characteristics of the two (2) categories of pension plan embedded options.

Commentary on Question:
Candidates in general were able to answer this part properly and concisely. They needed to describe the key characteristics of the embedded options and it was not necessary to go into details about how to value them.

Category 1 Embedded Options:

- Key drive:
  - Options are driven primarily employee behavior/election.
  - Economic factors may play a secondary role.
  - Economic factors are very difficult to isolate and their impact hard quantify (in terms of how they drive employee behavior).
  - Other factors may come into play (e.g. cultural norm, lifestyle, health conditions).
- What the options are:
  Category 1 options relate to options "granted" under specific terms of the plan.

2. Continued

Category 2 Embedded Options:

- Key drive:
  - Options are driven primarily by underlying economic variables, such as:
    - Interest rate
    - Market performance
    - Inflation rate

- What the options are:
  Category 2 options are either:
  - Entire plan types (e.g. in case of floor-offset plan); or
  - Distinct provisions of a plan which can be viewed as equivalent to options/derivatives that trade in capital markets. Behavior of these provisions can be replicated by options or other financial instruments.
- Misc:
  - Characterized by dynamics of "asymmetry."

(b) Describe the embedded options under each of the following retirement programs:

(i) A floor-offset plan.

(ii) A defined benefit pension plan with cost of living adjustments based on the change in the Consumer Price Index (CPI), with a floor of 1% and a cap of 6% per year.

(iii) A defined benefit pension plan with cost of living adjustments that provides pension increases if the prior year's rate of return on plan assets exceeds a "hurdle rate" of 8% per year.

Commentary on Question:
Most candidates managed to explain how each type of retirement programs worked. However, some failed to address how the embedded options worked in the context of the types of plans specified. Again, it was not necessary to provide the details on how to value the options.

It was also valid to explain how the embedded options worked in terms of financial derivatives, in which case, the candidate should have specified the holder/underwriter of the option (whether it is the employer or the plan participant) and the financial variable in consideration (e.g. fund rate of return, inflation… etc).

2. Continued

(i) A floor-offset plan

- A floor-offset plan consists of a DB and a DC plan components.
- The DB plan acts as a floor (i.e. establish the minimum guaranteed pension).
- The DC plan acts as 'base plan.'
- Upon benefit payment:
  - If the DC balance provides a benefit that is greater than DB floor, the participant receives the full DC balance and no benefit is paid from the DB plan.
  - Otherwise, the participant receives the full DC balance and the DB plan makes up the difference.
- The cost of the embedded option is the value of the DB minimum guarantee in excess of the DC balance upon benefit payment.
- The investment return on the DC plan is solely driven by economic variables.
- When the DC plan underperforms, plan sponsor needs to make up the difference (i.e. additional cost is incurred). This could happen:
  - Under adverse economic/financial conditions
  - When the market performance is poor
  - When bad investment decisions are made

(ii) A DB plan with COLA dependent on the change in CPI, with a floor of 1% and a cap of 6%

- After retirement/termination, plan benefit increase (or cost living adjustment) is granted each year based on the change in CPI over the year.
- Each year, the pension increase cannot be lower than 1% and cannot exceed 6%.
- The applicable index (CPI) is driven by inflation and is dependent on the economic phenomena.
- Additional cost is incurred to the plan sponsor when the CPI change generates a benefit increase of less than 1%. In this case, the employer needs to make additional contribution to provide for a 1% benefit increase.
- There will be savings for the plan sponsor when the CPI change generates a benefit increase of more than 6%. The resulting cost to the sponsor is limited by the 6% cap.

2. Continued

(iii) A DB pension plan with COLA that provides pension increases if the prior year's rate of return on plan assets exceeds a 'hurdle rate' of 8%

- After retirement/termination, plan benefit increase (or cost of living adjustment) is each year if the plan rate of return is greater than a pre-specified rate of return (i.e. the hurdle rate) of 8%.
- If the plan rate of return is less than 8%, the increase for that year is 0. If the plan rate of return is more than 8%, the increase for that year is the return in excess of 8%.
- The plan rate of return is solely driven by the underlying economic climate.
- When the plan rate of return exceeds 8%, the plan sponsor shares the success with the plan participants. This could happen:
  - Under favorable economic/financial conditions.
  - Market performance is great.
  - When good investment decisions are made.
- The cost of embedded option is related to the actual rate of return on assets. Even if the long term expected return is less than 8% p.a., there will be years when the return exceeds 8%.
- To correctly capture the cost of the embedded option, there should be a value assigned to the conditional indexing to reflect the fact that the return in some years will be above 8%.

(c) Determine the additional cost to the employer of the embedded options as of January 1, 2012 for the plan.

Commentary on Question:
Candidates in general did very well in this part. A handful of candidates mistakenly determined the additional pension, not the additional cost, due to the embedded option.

- DB floor annual pension = 1% × final year's earnings × years of service
  - Employee A: DB floor annual pension = 1% × \$60,000 × 5 = \$3,000
  - Employee B: DB floor annual pension = 1% × \$90,000 × 20 = \$18,000
- Value of DB Pension = annual pension × $\ddot{a}_{65}^{(12)}$
  - Employee A: value of DB pension = \$3,000 × $\ddot{a}_{65}^{(12)}$ = \$3,000 × 15 = \$45,000
  - Employee B: value of DB pension = \$18,000 × $\ddot{a}_{65}^{(12)}$ = \$18,000 × 15 = \$270,000
- Cost of embedded option = Max(\$0,Value of DB floor - DC balance):
  - Employee A: cost = Max(\$0,\$45,000 - \$50,000) = \$0
  - Employee B: cost = Max(\$0,\$270,000 - \$185,000) = \$85,000
- Total cost to the Employer is sum of cost for each employee:

= \$0 + \$85,000 = <u>\$85,000</u>

2. Continued

Alternatively, candidates may answer the question by comparing the equivalent pension instead.

- DB floor annual pension = 1% × final year's earnings × years of service
  - Employee A: DB floor annual pension = 1% × \$60,000 × 5 = \$3,000
  - Employee B: DB floor annual pension = 1% × \$90,000 × 20 = \$18,000
- Actuarial equivalence of DC Pension = DC balance ÷ $\ddot{a}_{65}^{(12)}$
  - Employee A: equivalent DC pension = \$50,000 ÷ $\ddot{a}_{65}^{(12)}$ = \$50,000 ÷ 15 = \$3,333.33
  - Employee B: equivalent DC pension = \$185,000 ÷ $\ddot{a}_{65}^{(12)}$ = \$185,000 ÷ 15 = \$12,333.33
- Cost of embedded option = Max(\$0, DB floor - DC equivalent pension) ×$\ddot{a}_{65}^{(12)}$:
  - Employee A: cost = Max(\$0,\$3,000 - \$3,333.33) × $\ddot{a}_{65}^{(12)}$ = \$0 × 15 = \$0
  - Employee B: cost = Max(\$0,\$18,000 - \$12,333.33) × $\ddot{a}_{65}^{(12)}$ = \$5,666.67 × 15 = \$85,000
- Total cost to the employer is sum of cost for each employee:
  = \$0 + \$85,000 = <u>\$85,000</u>

(d) You are the actuary for a company that sponsors a defined benefit pension plan that provides annual post-retirement indexing of 50% of the increase in CPI during the previous calendar year.

For actuarial valuation purposes, the current CPI increase assumption is 2.5% per year.

During collective bargaining negotiations, the union requested amending the plan to provide minimum post-retirement indexing of 0.5% per year, arguing that there is no additional cost to the company.

Evaluate the union's argument.

Commentary on Question:
Most candidates correctly explained there were additional costs associated with the union's proposed minimum guarantee, however only few candidates reflected on the impact of the increased liabilities.

- There is real probability of additional cost to the company.
  There is cost associated with the proposed minimum guarantee in the years when CPI is less than 1%.
  No additional cost otherwise.
- This is because when CPI is less than 1%, the benefit increase is:
  - < 0.5% under the current plan

2. Continued

  - = 0.5% under the proposed plan (i.e. the increase is higher than under the current plan).
- During low inflationary period, the proposed guarantee will have the most value and create the most additional cost to the plan sponsor.
- The cost of the proposed guarantee will need to be captured when valuing the plan.
- Current valuation assumes a fixed CPI increase of 2.5% p.a. However, if a CPI assumption of more than 1% is used, the proposed guarantee will be shown to have no value (i.e. asymmetric effect).
  The 2.5% valuation assumption represents long term average expectation of CPI increase, which includes years higher than 2.5% and years lower than 2.5%.
- When the additional cost associated with the proposed guarantee is captured, the plan liabilities will increase. Hence:
  - From funding perspective, this plan change will increase the funding requirements.
  - For accounting, this plan change will:
    - Increase the PBO, and impact the funded status (reduce surplus or increase deficit)
    - Increase the pension expense
    - Impact the adjustment in retained earnings
    - Affect the balance sheet and company financials.
  - Cashflow implication: the actual benefit payments will be higher under the proposed plan in the years when CPI is less than 1% (see above).
- Misc:
  - Admin: This plan change adds to admin complexity. Costs more admin fees.

3. Learning Objectives:

6. The candidate will be able to analyze/synthesize the factors that go into selection of actuarial assumptions.

Learning Outcomes:

(6c) Evaluate appropriateness of current assumptions given the purpose

Sources:

RD -114 – 07 Introduction to duration for pension actuaries

Commentary on Question:

In this question, a well prepared candidate would have calculated the duration properly, estimated the revised liability for a change in discount rate and understood the limitations of duration to estimate the liability.

There were three possible ways to arrive at the correct duration for part (a). The first possible method is to use first principles and solve for the negative of the first derivative of the liability with respect to the interest rate divided by the liability. The second and simpler way to approximate the duration is to determine the liability at interest rate (i + 0.0001). The third possible method is to use the Modified duration formula.

A summary of the differences between Macaulay and modified duration from Wikipedia: Note that the Macaulay duration formula calculates the weighted average maturity of cash flows. Macaulay duration and modified duration are both termed "duration" and have the same (or close to the same) numerical value, but it is important to keep in mind the conceptual distinctions between them. Macaulay duration is a time measure with units in years, and really makes sense only for an instrument with fixed cash flows.

Modified duration, on the other hand, is a derivative (rate of change) or price sensitivity and measures the percentage rate of change of price with respect to yield. The concept of modified duration can be applied to interest-rate sensitive instruments with non-fixed cash flows, and can thus be applied to a wider range of instruments than can Macaulay duration. From a pension actuaries' perspective, the modified duration is almost always used in day to day practice and the first principles definition is what is shown on the syllabus. Candidates were not given full marks if they used the Macaulay duration.

Part (b) was relatively well done, but many candidates did not show their work.

For part (c), many candidates stated that duration would not be appropriate for estimating a liability with a large change in rates. The study note states that duration is more accurate for small changes in interest rates, but is silent on its accuracy for larger changes in rates. There could be instances where duration is used as a back of the envelope check on actual liabilities. In this case, duration could be an appropriate way of estimating the liability but should be used with a high degree of uncertainty.

3. Continued

Solution:

(a) Calculate the duration. Show all work.

The duration of a liability is the negative of the first derivative of the liability with respect to change in the assumed interest rate, divided by the liability.
An appropriate approximation is to compare the present value with the present value calculated at i + 0.01%.

Present Value =
200 X (1.01)^-5 + 300 X (1.02)^-9 + 500 X (1.03)^-12 + 600 X (1.04)^-16 = 1,112.355
Present Value i + 0.01% =
200 X (1.0101)^-5 +300 X (1.0201)^-9 + 500 X (1.0301)^-12 + 600 X (1.0401)^-16 = 1,111.138
Duration = -(Change in PV/change in DR)/PV
= -((1,111.138 – 1,112.355)/0.0001)/1,112.355
= 10.94

(b) A pension plan has a liability of $100,000,000 with a duration of 8. Calculate the estimated liability after a 50 basis points increase in the discount rate, using duration techniques.

The change in liability is inversely proportional to the duration times change in interest rate
Estimated change in liability = -100,000,000 x 8 x 0.005 = -4,000,000
Estimated liability = 100,000,000 – 4,000,000 = 96,000,000

(c) Discuss the appropriateness of estimating the revised liability, using duration for a 200 basis point change in the discount rate.

Duration is only an approximation and is more accurate for small changes in the discount rate. However, duration may still be appropriate if used as a back of the envelope check, but should be used with a high degree of uncertainty. Other issues with duration are that interest rates do not change continuously, but in increments of 10 and 25 bps; and duration does not capture convexity. The actuary should also consider the extent to which other variables used in the calculation of the liability are assumed to change as the interest rate changes. (i.e. salary scale, or lump sum).

4. Learning Objectives:

2. The candidate will be able to understand how the regulatory environment affects plan design and understand how to apply relevant restrictions.

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

9. The candidate will be able to understand principles and rationale behind regulation.

Learning Outcomes:

(2a) Explain and apply the regulatory limits placed on types of plans that can be offered.

(5a) Differentiate between the various purposes for valuing pension plans:
- (i) Budgeting
- (ii) Funding
- (iii) Accounting
- (iv) Solvency
- (v) Termination/wind up
- (vi) Economic value

(9b) Describe the principles and motivations behind legislated restrictions.

Sources:

The Impact of the Financial Crisis on Defined Benefit Plans and the Need for Counter-Cyclical Funding Regulations, OECD B

Canadian Pensions and Retirement Income Planning (Canada)

Ontario Pension Benefits Act RRO 1990, Reg 909 (Canada)

Commentary on Question:

In this question, candidates were asked to demonstrate their knowledge of OECD country responses to the recent financial crisis and OECD recommendations for counter-cyclical funding regulations.

A well prepared candidate was expected to know strategies used by OECD countries in the recent financial crisis and describe how three OECD counter-cyclical regulatory concepts affect sustainability and security of defined benefit plans.

Solution:

(a) Identify four temporary regulatory changes Organization for Economic Co-operation and Development (OECD) countries have used to address defined benefit funding challenges as a result of recent financial crises. References to specific countries are not required.

4. Continued

Commentary on Question:
For part (a), many candidates identified an increase in the amortization period, but relatively few candidates identified the many other changes described in the OECD study note. Credit was given for recent Canadian regulatory changes contained in a syllabus reading.

(1) Increased recovery period from 5 to 10 years for federally regulated plans; several provinces extended similar relief.

(2) Temporarily lifted requirement to use market interest rates to compute pension liabilities; also submit quarterly reports instead of supervisory traffic light.

(3) Secured solvency requirements without forced sales of securities in weak market.

(4) Gave additional time to prepare funding proposals and longer recovery periods; plus voluntary employer guarantees in approving funding proposals.

(b) For the following three (3) counter-cyclical regulatory concepts, describe how each improves both the sustainability and security of defined benefit plans in the future:

(i) Avoid excessive reliance on current market values for purposes of determining contributions (i.e. permit smoothing techniques).

Commentary on Question:
Part (b)(i) responses focused more on sustainability than security.

Sustainability
Smoothing discount rates reduces volatility and maintains predictability, improving sustainability of DB plans in future.

Market discount rate for liabilities increases volatility of contributions.

Security
This reduction in volatility from smoothing discount rates also improves security of DB plans in future.

Use smoothed rates to avoid rush changes in funding and investment strategies that may be counterproductive in the long run.

4. Continued

Basing contributions on day-day market fluctuations is counterproductive for 3 pension funding goals - long term viability, stability and security.

However, smoothing has limitations. If smoothing period is too long, minimum contributions can be too low, which led to significant US plan terminations.

(ii) Allow appropriate levels of over-funding in good economic times via more flexible tax ceilings.

Commentary on Question:
For part (b)(ii), many candidate responses described the buffer shown in the model solution below, but relatively few other responses based on a syllabus reading were received.

Sustainability
Can act as buffer in bad times when liabilities rise due to lower discount rates and asset values plunge.

Maximum contribution ceilings can be smoothed over several years to allow greater management of cash flows by the plan sponsor.

Security
Increased funding levels directly increase DB plan security.

Governments should consider raising maximum level of surplus before contributions must be suspended.

Can also introduce smoothing into maximum limit, e.g. by setting maximum equal to specified percentage above smoothed minimum funding requirement.

Can leave surplus in fund to build contingency reserve to offset future experience losses, subject to limits.

(iii) Flexible funding rules that reflect overall volatility of funding valuations.

Commentary on Question:
Part (b)(iii) responses also focused more on sustainability than security.

4. Continued

Sustainability
Recovery periods to eliminate DB funding deficits should reflect overall volatility of funding levels, which improves sustainability.

Should structure funding rules to not put undue pressure on plan sponsors when their profitability/continuity is in jeopardy.

Use longer recovery period if little smoothing in computing funding level, or shorter period if smoothing is used.

Security
Flexibility in funding rules can be complemented with other enhancements to member security, e.g. insurance against plan sponsor bankruptcy or giving plan members priority creditor status.

Contingent assets can be used - these transfer from the sponsor to the scheme under certain conditions.

Canada permits letters of credit up to 15% of plan assets and employers would not be required to remit cash amounts to the fund.

5. Learning Objectives:

2. The candidate will be able to understand how the regulatory environment affects plan design and understand how to apply relevant restrictions.

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

8. The candidate will be able to evaluate the actuarial considerations in plan options and administration.

Learning Outcomes:

(2a) Explain and apply the regulatory limits placed on types of plans that can be offered.

(2b) Explain and apply restrictions on plan design features to a proposed plan design.

(5b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using the variety of cost methods for budgeting, funding accounting and measuring economic value.

(8a) Assess the gain/loss from options offered, including:

- Phased retirement
- Postponed retirement
- Early retirement
- Option factors
- DROPs

Sources:

Pension Mathematics for Actuaries, Anderson, 3rd Edition

Watson Wyatt Canadian Pensions and Retirement Income Planning Morneau Sobeco, 14th edition
R-D612-10

Commentary on Question:

In this question, candidates were asked to perform a funding valuation and determine contribution requirements for a non-designated pension plan registered in Ontario and analyze the gains and losses by source. They were also asked to demonstrate their understanding of the funding requirements for a designated plan.

A well prepared candidate would have been able to calculate the funded position on a going concern and solvency basis to determine the minimum and maximum contribution requirements in part (a) in accordance with the ITA and PBA for Ontario registered plans, perform gain and loss by source in part (b) and discuss the maximum funding rules for a designated plan in part (c).

5. Continued

Solution:

(a) Calculate the minimum required and maximum permissible employer contributions for 2012. Show all work.

Commentary on Question:
Candidates generally did well in part (a); however, certain candidates didn't realize that the going concern deficit position decreased from the prior year and they incorrectly created a new schedule of going concern amortization payments instead of reducing the payment in the existing schedule. Also, some candidates reduced the payment period instead of reducing the payment amount of the going-concern schedule. A few candidates eliminated the existing going-concern schedule entirely instead of reducing the payment. Some candidates also failed to realize that the Normal Cost for the active member is zero since the member has reached the assumed retirement age. Points were given for showing all work.

Calculate going concern (GC) and solvency (solv) liabilities

Active Member Accrued Pension at 1.1.2012

Accrued Benefit = min (2* Final Earnings$_{2011}$*svc, Dollar DB Limit*svc)
=min(2%*225000*10, 2646.67*10)
=26,466.70

GC Liability at 6%

Active Liab = Accrued Benefit*ä62
=26,466.7*11.7
= 309,660

Inactive Liab = Retiree Pension* ä71
= 12000*9.3
= 111,600

Total GC Liab = 421,260

Solv Liability at 3.3%

Active Liab = Accrued Benefit*ä62
= 26,466.7*15.2
= 402,293

Inactive Liab = Retiree Pension* ä$_{71}$
= 12000*11.2
= 134,400

Total Solv Liab = 536,693

5. Continued

Valuation Results at 1.1.2012

Going Concern Position:

GC Surplus/(Deficit) = MV of Assets – Liabs

= 400,000 - 421,260=(21,260)

Solvency Position:

Solv Surplus/(Deficit) = MV of Assets - WUP expense- Liabs

= 400,000 - 50,000 - 536,693 = (186,693)

NC is 0 since member is age 62 (ie. assumed retirement age)

Note: This model solution uses annuity certain (compounded monthly) to determine present value of amortization payments.

Determine the going concern amortization payments at 1.1.2012:

PV of existing GC amortization payments: 2500 x ä 14

= 2500*9.5

= 23,750

Reduced amortization payment = 21,260/ä 14

= 21,260 / 9.5

= 2,238

Determine the solvency amortization payments at 1.1.2012:

PV of existing GC and solvency schedules:

GC 1 =2,238* ä 5

= 2,238*4.6

= 10,295

Solv 1 = 15,000* ä 3

= 15,000 * 2.9

= 43,500

Solv 2= 20,000* ä 4

= 20,000 * 3.8

= 76,000

Total = 129,795

Determine statutory solvency deficit (adjusted solvency deficit)

5. Continued

Adjusted Solvency Deficit = Solvency Deficit - PV of existing GC and solvency schedules

Adjusted Solvency Deficit = 186,693-129,795
= 56,898

New Solv amortization schedule = 58,498/ä 5
= 56,898/4.6
= 12,369

Minimum Required Contributions = NC + Solv Amortization Pmts + GC Amortization Pmts
=2,238 + 15,000 + 20,000 + 12,369
= 49,607

Maximum Contributions = NC + Max (GC Deficit, Windup Deficit)
= 0+max(21,260,186,693)
= 186,693

(b) During 2012, the pension fund earned 3%, there were no decrements and all other experience was in line with the assumptions. The employer contributed the minimum required contribution on January 1, 2012. There are no assumption changes as at January 1, 2013.

Calculate the going concern gain and loss by source as at January 1, 2013. Show all work.

Commentary on Question:
The majority of the candidates realized that there was investment gain and loss. However, some candidates incorrectly interpreted the statement "there were no decrements" to mean that there were no demographic gains or losses and failed to calculate the retirement and mortality gain and loss. Also, some candidates determined the overall gain and loss and failed to show the gain and loss by source. Furthermore, many candidates failed to reflect the retiree pension payments in the calculations of the assets at January 1, 2013.

Compound or simple interest may be used.
Investment Gain & Loss
Actual Assets at 1.1.2013 = 400000*(1.03)+49,607*(1.03)-(1000*12)*(1.03)^0.5= 450,927
Expected Assets at 1.1.2013 = 400000*(1.06)+49,607*(1.06)-(1000*12)*(1.06)^0.5 = 464,229

Formula: Investment G/(L) = Actual Assets - Expected Assets
Investment (Loss) = 450,917-464,229 = (13,312)

5. Continued

Retirement Gain & Loss

Accrued Benefit at 1.1.2013 for active member

Final Earnings$_{2012}$= 225000*1.03 = 231,750

2012 DB Dollar Limit = 2,646.67 (dollar limit increase assumption was also accepted)

Accrued Benefit = min (2* Final Earnings$_{2012}$*svc, Dollar DB Limit*svc)

= MIN(2%*231,750*11, 2,646.67*11)

= 29,113.37

Actual Active GC Liability at 1.1.2013 = Accrued Benefit* ä $_{63}$

= 29,113.37*11.5

=334,804

Expected Active Liab at 1.1.2013 = (Liab at 1.1.2012 +2012 NC) * (1+GC rate)

=309,660*(1.06)

= 328,240

Formula: Retirement Gain & Loss = Actual Liability - Expected Liability

Retirement Loss = 334,804 - 328,240 = 6,564

Mortality Gain & Loss

Actual Retiree GC Liability at 1.1.2013 = 12,000 * ä 72

= 12,000 * 9.0

= 108,000

Expected Retiree Liability at 1.1.2013 = Liab at 1.1.2012 * (1 + GC rate) - BP * (1 + GCrate /2)

= 111,600 * 1.06 - 12,000 * 1.03

= 105,936

Mortality Gain = Expected Liability - Actual Liability

Loss = 108,000 - 105,936 = 2,064

(c) Discuss the effect on the minimum required and maximum permissible contributions if the plan were considered a Designated Plan as of January 1, 2012. No calculations are required.

Commentary on Question:
Part (c) was poorly answered by some candidates. Candidates who did well on this question were able to describe the maximum funding valuation and indicate their understanding of the upper limit placed on the contributions.

For designated plans, contributions must be determined on the basis of a separate maximum funding valuation as prescribed by the ITA (using prescribed assumptions and actuarial methods).

5. Continued

To determine minimum and maximum contributions, three valuations are performed (going-concern, solvency and maximum funding valuation) Contributions determined under the Maximum Funding valuation put an upper limit on employer contributions.

The following examples also earned points:

- If contributions under maximum funding rule are lower than minimum required under the "normal" funding valuation, then the minimum required would be capped by the contributions under the maximum funding valuation.
- If contributions under maximum funding valuation are between the minimum and maximum required under "normal" funding valuation, then the minimum required contributions are the same as "normal" funding valuation but maximum permitted would be capped at contributions under maximum funding valuation.
- If contributions under max funding rule are higher than the maximum permitted under normal funding valuation, then the minimum and maximum contributions would be as per the "normal" funding valuation.

6. Learning Objectives:

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

Learning Outcomes:

(6c) Evaluate appropriateness of current assumptions given the purpose.

(6g) Recommend appropriate assumptions for a particular type of valuation (e.g., ongoing, termination, etc.) and defend the selection.

Sources:

CIA Educational Note – Determination of Best Estimate Discount Rates for Going Concern Funding Valuations

CSOP 3230.01 – 3230.03, 3260.02

ASOP No. 27

ASOP No. 35

CSOP 1700

Commentary on Question:

In this question, candidates were asked to demonstrate how assumptions are selected and analyzed.

This question first tests the candidates' knowledge and understanding of the CIA Educational Note on selection of a going concern discount rate. While a large portion of the expected answer should come from this note, candidates are also expected to refer to other material on the syllabus that deals with selection of discount rate and assumption selection in general.

The second part of this question tests the candidate's ability to assess the appropriateness of specific assumptions, mortality and retirement in this case, by referring to assumption selection material and by looking at the specific situation of the Salaried Plan in the case study.

A well prepared candidate would have been able to outline the process to be used for setting a going concern discount rate, outline the factors to consider when setting a going concern discount rate and be able to relate the theory to the case study.

Solution:

You have been asked to review NOC‘s Full-Time Salaried Pension Plan’s going concern valuation assumptions.

6. Continued

(a) Describe the factors to consider when setting the Plan's going concern discount rate, taking into consideration the Canadian Institute of Actuaries' December 2010 Educational Note on the Determination of Best Estimate Discount Rates for Going Concern Funding Valuations.

Commentary on Question:
The majority of candidates were able to identify the building block approach although many simply listed the elements of this approach without providing a good explanation of the underlying philosophy of the approach. Some candidates were able to identify the cashflow matching approach and few identified the use of yields on government of Canada fixed income as a subset of cashflow matching. Few candidates were able to discuss the other considerations.

Revised Standards of Practice state that the actuary should select *best estimate* assumptions:

- Incorporate margins for adverse deviations if required:
  - By law
  - By terms of an appropriate engagement

Two distinct approaches may be taken to setting discount rate:

(1) Discount rate may be based on expected future investment return on assets of pension plan

- Typically this will be a long-term horizon such as 20-30 years.

- An acceptable methodology for approach (1) is the *building block* approach:
  - A discount rate may be based on expected future investment return on assets of pension plan.

(i) Determine best estimate of long-term, *expected future investment returns for various asset classes*;
(ii) Combining best estimate long-term, expected future investment returns for different asset classes to reflect a plan's investment policy with consideration of effects of *diversification and rebalancing*;
(iii) Considering inclusion of an allowance for additional return due to *active versus passive management*, where appropriate; and
(iv) Making appropriate provision for *expenses*.

- Could also use a *stochastic* methodology for (1)
  - More sophisticated than building block.

6. Continued

(2) Discount rate may be based on yields of investment grade debt securities which reasonably match projected benefit cash flows, with an appropriately low level of risk, regardless of plan's assets.

- An acceptable methodology for approach (2) is *cashflow matching*:
  - A discount rate may be based on *yields of investment grade debt securities* (fixed income) which would reasonable match projected benefit cashflows with an appropriate low level of risk, regardless of plan's assets.
  - *Does not identify an explicit inflation component of investment return*. Actuary will need to estimate inflation rate implicit in bond portfolio's internal rate of return to test for consistency with other economic assumptions.

- Discount Rate Based on Fixed Income Yields:
  - Should reflect yields on Government of Canada or other high-quality bonds that reasonably match projected benefit cash flows or have a duration comparable to projected benefit cash flows.
  - Select and ultimate rates may be used to approximate effect of using a full yield curve.

Other considerations when selecting discount rate include:

- Actuary should consider a range of information:
  - For plan where assets are invested in Tbills or bonds (and expected to remain that way) then long-term investment return is market yield on the particular investments or yield on a market index representative of such investments.
  - Allowance should be made for reinvestment and effect of possible changes in interest rates in future investments.
  - Actuary may use the premise that there are higher risk asset classes and low risk assets (such as investment grade debt securities) and that higher risk asset classes will have higher volatility of returns.
    - i.e. may set a risk premium equal to expected return on plan assets in excess of expected return on risk-free assets and include this in best estimate assumption.
- Actuary may assume that investments will be guided by investment policy indefinitely unless information suggests policy will change.
- Should assume no additional return from active management unless actuary has reason to believe they will be consistently and reliably earned over the long term, supported by sufficient and relevant data.
- Can assume additional return up to difference in fees between passive and active management.

6. Continued

- Alternative asset classes.
  - May not be practical to define a relevant index or distinguish between active and passive.
  - Actuary would make assumptions for return from particular asset class or strategy.
  - Actuary would generally not assume that a particular manager would outperform other managers with similar mandate.
  - If allowance has been made for added value for active management equal to difference in fees, then provision for expenses fees should include the additional fees for active management
- Rounding
- Each economic assumption selected should be consistent with every other economic assumption selected over measurement period unless assumption, considered individually, is not material.
  - Can be met by using same inflation component in each of economic assumptions.
- Consistency is not met by simply changing all assumption by 0.5% if discount rate changes by 0.5% in any given year.
- When an assumption is prescribed, the actuary is obligated to use it.

Actuary should review appropriate investment data including:

- Current yields to maturity of fixed income securities such as government securities or corporate bonds.
- Forecasts of inflation and total returns for each asset class.
- Historical investment data, including real risk-free returns, the inflation component of return and the real return or risk premium for each asset class.
- Historical plan performance.

(b) Based on your analysis, you have proposed a decrease in the discount rate of 0.5%. NOC has requested that the discount rate remain unchanged. Prepare a response to NOC's request taking into consideration the applicable professional standards.

Commentary on Question:
Most candidates erroneously made reference to the Code of Professional Conduct to answer this question. They viewed this as an ethics question and responded in a very simplistic manner. Consequently, few candidates made any arguments for keeping the discount rate unchanged. It was rare for the candidates to tie their responses to the case study as was clearly requested in the question.

(1) Arguments supporting decreasing the discount rate by 0.5%:

- CSOP 1700 states that:

6. Continued

- Assumptions that the actuary selects or for which the actuary takes responsibility should be *appropriate* in the aggregate.
  - Should also be *independently reasonable* unless the selection of assumptions that are not independently reasonable can be justified.
- If actuary does not take responsibility for an assumption, then should so report.
  - If actuary considers it practical and useful to do so, actuary should report result of alternative assumption.

Case study:

- If actuary cannot take responsibility for the assumption and notes it in the report, NOC may alter its opposition to dropping the discount rate.
- Over the course of the period presented in the case study the asset mix of the plan has changed with an increasing weight toward fixed income

- Drop of discount rate to 6.0% was possibly the result of large increase in fixed income weighting.
- Between January 1, 2011 and 2012 there was a further shift of 5% to fixed income but no change in the discount rate.
- Between January 1, 2011 and 2012 equity weighting was dropped 5% without a change to the discount rate.
- NOC cannot continue to be this aggressive with discount rate
- Only results in continued investment losses (as witnessed over the 3 of the last 4 years).
  - These continual investment losses may spark regulatory attention (a request may be received to review discount rate).
- Decreasing discount rate would increase GC liabilities, the unfunded liability and GC special payments, but solvency will still likely drive funding.
- Decreasing discount rate will also increase the normal cost and special payment contributions.
  - This will result in more stable contributions over the long term but increased funding requirements in the short term.

(2) **Arguments supporting leaving the discount rate unchanged:**

- CSOP 1700 states that:
  - Actuary should select each needed assumption except for those, if any, which are stipulated by the terms of the engagement.
  - Describe the extent of any margin for adverse deviations included in the discount rate assumption.

6. Continued

Case study:

- NOC could stipulate that the going concern valuation should contain no margins.
- Removing margins could result in no need to change the discount rate.
- Could simply shrink the margin (but not fully eliminate it) to achieve stable discount rate.
  - In a low interest rate environment, the size of the margin can shrink because the margin exists to guard against just such a type of environment.
- Reasonable assumption would reflect current conditions as of the calculation date but would not necessarily have to continue to reflect current conditions persisting into the future.
  - As current interest rates are extremely low in relation to past rates or future expectation, it would not be unreasonable to assume that interest rates change over time.
  - This could allow the actuary to modify his discount rate model input assumptions to account for a reversion to the mean on interest rates.
- Actuary could look into value added returns from active management:
- Actuary could look into whether rebalancing and diversification adjustment was used.
  - Often assumed plan assets are sufficiently diversified and rebalanced regularly to avoid deviating too far from 'target' asset mix.
  - Average annual long-term rates of return for individual asset classes are calculated geometrically, (by determining compound average annual rates of return over long periods), long-term average return for a diversified portfolio (regularly rebalanced) will exceed weighted average of long-term average rates of return on individual asset classes.
  - Assuming balanced portfolio is maintained closely to the original 'target' asset mix, allowance for 'diversification effect' typically is in range of 0% to 0.5% per annum, where 0% applies when investments are solely in one asset class (e.g., bonds).
  - For portfolios with allocation to multiple asset classes, 'diversification effect' is typically 0.3% to 0.5% per annum, in addition to weighted geometric average of expected returns of each asset class, weighted by portfolio target percentages.

7. Learning Objectives:

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

Learning Outcomes:

(5b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using the variety of cost methods for budgeting, funding accounting and measuring economic value.

Sources:

Pension Mathematics for Actuaries, Anderson, Third Edition, 2006

"A Practical Approach to Gains Analysis Revisited" by Andrew Smith, Pension Section News, Sept. 93 Both

Commentary on Question:

In this question, candidates were asked to demonstrate their understanding of the individual level premium cost method and assumption gains and losses.

A well prepared candidate would have been able to:

- Determine the pension payable at normal retirement
- Apply actuarial equivalence factors to determine the optional form pension under a joint and survivor basics
- Determine actuarial liability and normal cost under the individual level premium cost method
- Determine the experience gains/losses over the year compared to what was expected.

Some candidates used the level percent approach for the individual level premium cost method. While the question did not specify which approach to use, it should be understood that the level dollar approach should be used (and not the level percent approach) unless otherwise specified. If the level percent approach was used, candidates should have stated the methods/assumptions used and have written down all applicable formulas in order to get partial marks when the two cost methods have calculations in common.

Candidates did well in calculating the pension payable at normal retirement and the amount under the optional form, but less so for the calculations of accrued liability, normal cost and gain/loss mainly due to using the incorrect cost method, which accounted for most of the marks. A good paper would show all steps of the work and show the formulas used in deriving the answers.

Solution:

(a) Employee B elected a Joint and Survivor 60% Pension. Calculate his monthly pension amount as at December 31, 2012.

7. Continued

Value of Benefit at 65
= 1.5% x 2012 Salary x years of service at 65 x $\ddot{a}_{65}^{(12)}$
= 1.5% x $90,000 x 21 years x 12
= $340,200

JS60% pension
= value / ($\ddot{a}_{65}^{(12)}$ + 0.6 x $\ddot{a}_{62}^{(12)}$ - 0.6 x $\ddot{a}_{65:62}^{(12)}$)
= 340,200 / (12 + 0.6 x 13.5 - 0.6 x 11.5)
= 25,772.73

Monthly pension
= annual pension / 12
= 25,772.73 / 12
= 2,148

(b) Calculate the actuarial liability as at January 1, 2013.

Employee A
$NC_{35}^{A} = B_{65} \times v^{30} \times \ddot{a}_{65}^{(12)} / \ddot{a}_{30|}$
= 0.015 x $60,000 x 1.0375^{29} x 30 x $(1.0525)^{-30}$ x 12 / ((1 – 1.0525^{-30}) / 0.0525 x 1.0525)
= $12,907.76

$AL_1^A = NC_{35}^A \times (1+i)$
= $12,907.76 x 1.0525
= $13,585.42

Employee B
$AL_1^B = B^{NF}_{65} \times \ddot{a}_{65}^{(12)}$
= $28,350 x 12
= $340,200

$AL_1 = AL_1^A + AL_1^B$
= $13,585.42 + $340,200
= $353,785

(c) Calculate the 2013 normal cost and the unfunded actuarial liability as at January 1, 2013.

Sources of gains/losses:
Retirement gains/losses = $0 as Employee B has retired, so no further normal cost

7. Continued

Salary gains/losses

$\Delta NC_{36} = \Delta B_{65} \times v^{29} \times \ddot{a}_{65}^{(12)} / \ddot{a}_{291}$

$= 0.015 \times (\$60{,}000*1.03*1.0375^{28} - \$60{,}000*1.0375^{29}) \times 30 \times 1.0525^{-29} \times 12 / ((1 - 1.0525^{-29}) / 0.0525 \times 1.0525)$

$= \$(99.64)$

Normal cost in 2013 = 2012 Normal Cost - Gain due to Salary increase
= 12,907.76 - 99.64
= $12,808.12

Assets in 2013 = Assets in 2012 x (1 + ROR) + ER cont
= $300,000 x (1+0.03) + $40,000
= $349,000

UAL in 2013 = AL in 2013 - Assets in 2013
= $353,785 - $349,000
= $4,785

8. Learning Objectives:

3. The candidate will be able to analyze plans designed for executives or the highly paid

Learning Outcomes:

(3a) Given a specific context, apply principles and features of executive deferred compensation retirement plans.

(3b) Given a specific context, apply principles and features of supplemental retirement plans

Sources:

Morneau Sobeco Chapter 11 page 267-273

Allen Chapter 14 page 253-259

Commentary on Question:

In this question, candidates were asked to demonstrate their knowledge on:

(a) How different SERP designs can help the client achieve the objectives of cost containment, benefit adequacy and attraction/retention.

(b) Calculate the replacement ratio for each member from two different plan designs.

(c) Evaluate each plan design from part (b) based on the client's objectives.

A well prepared candidate would have provided comments/insights on different plan designs available for executives from the perspective of cost containment, benefit adequacy and attraction/retention in part (a), calculate the ratios properly in part (b) and analyze them in part (c).

Solution:

(a) Describe how different Supplemental Executive Retirement Plan (SERP) designs could address your client's objectives in cost containment, benefit adequacy and attraction/retention.

Commentary on Question:

Candidates generally did well on this section. However, certain candidates missed the key words "plan designs" and concentrated on describing various SERP funding strategies.

Cost Containment plan design options:

- Have strict eligibility requirements which reduced the number of members. Do not use Top-Up plan where all members who pop over tax limits are eligible.

8. Continued

- Limit definition of pensionable pay to base salary or use career average formula.
- Limit service.
- Consider using DC SERP arrangement.
- Do not provide ancillary benefits on SERP accruals.

Benefit Adequacy plan design options:

- Integrate with registered plan to target a minimum replacement ratio for those limited by tax limits
- Provide cost of living increases pre and post retirement
- Use shorter FAE period and include bonus in pensionable pay.
- Grant past service credits to mid-career hires.
- Use generous benefit formula.

Retention and Attraction plan design options:

- Grant past service credits to encourage mid-career hires to join.
- Employ strict vesting requirements to retain employees.
- Include non-compete provisions on SERP accruals
- Use defined benefit formula. The more generous the formula, the better the attraction. The shorter the averaging period, the better the attraction.
- Provide additional benefits if employees meet designated service levels to encourage retention.

(b) Calculate the replacement ratio at their Normal Retirement Age assuming they are fully vested.

Commentary on Question:
This was a calculation question and most candidates did well on this section. Some of the common mistakes made are:

- Calculated the wrong final average earnings (earnings needed to be increased by one year's salary scale to be current).
- In calculating the replacement ratio for member A and B, candidates were not consistent in the final salary (whether to include bonus or not). Replacement ratios need to be consistent in order to be comparable.

Earnings calculations were not strictly required to find the replacement ratios. However, they have been included since all candidates used them.

1. Member A

Base Salary for the period of Jan 1, 2012 to Dec 31, 2012 (age 55) = $500,000 x 1.05 = $525, 000

8. Continued

Member's NRD is age 62, to calculate the final average earnings, need salary at ages 59, 60 and 61
Base Salary for age 59 = $525,000 x 1.05 ^ 4 = $638,141
Base Salary for age 60 = $525,000 x 1.05 ^ 5 = $670,048
Base Salary for age 61 = $525,000 x 1.05 ^ 6 = $703,550

Final average earnings (FAE) at age 62 = (salary at age 59 + salary at age 60 + salary at age 61)/3 = ($638,141 + $670,048 + $703,550)/3
= $670,580

Credited service accrued at age 62 = 8 + (62-55) = 15

Accrued pension at age 62 = 4% x FAE x min (10, 15) + 7% x FAE x max (15-10, 0) = $502,935

Replacement Ratio at age 62 = accrued pension at age 62/ total salary at age 61
= $502,935/($703,550 x 1.2)
= 60%

2. Member B

Base Salary for the period of Jan 1, 2012 to Dec 31, 2012 (age 50) = $250,000 x 1.04 = $260, 000
Total Salary (with bonus) at age 50 = $260,000 x 1.01 = $286, 000

Member's NRD is age 65, to calculate the final average earnings, need total salary at ages 60 to 64
Total Salary (incl. bonus) for age 60 = $286,000 x 1.04 ^ 10 = $423,350
Total Salary (incl. bonus) for age 61 = $525,000 x 1.04 ^ 11 = $440,284
Total Salary (incl. bonus) for age 62 = $525,000 x 1.04 ^ 12 = $457,895
Total Salary (incl. bonus) for age 63 = $525,000 x 1.04 ^ 13 = $476,211
Total Salary (incl. bonus) for age 64 = $525,000 x 1.04 ^ 14 = $495,259

Final average earnings (FAE) at age 65 = (sum of salary from age 60 to 64)/5
= ($423,350+$440,284+$457,895+$476,211+$495,259)/5
= $458,600

Credited service accrued at age 65 = 12 + (65-50) = 27

Accrued pension at age 65 = 2% x FAE5 x = $247,644

Replacement Ratio at age 65 = accrued pension at age 65/ total salary at age 64
= $247,644/$495,259
= 50%

8. Continued

(c) Evaluate each plan design in (b) based on your client's objectives of cost containment, benefit adequacy and attraction/retention.

Commentary on Question (c):
Candidates generally did well on this section.

1. Cost Consideration
   - Plan A has an overall generous plan design, thus may be more costly than Plan B, even though plan B has a more generous pensionable earnings definition.
   - Plan A has very generous accrual rate which is more than the 2% maximum accrual rate for a RPP.
   - Plan A has an earlier Normal Retirement Date than Plan B, so Plan A has a longer payout period and higher early retirement subsidies, which makes the plan more costly.
   - Plan A has a shorter averaging period for final average earnings, which generally leads to a higher FAE, which leads to a higher benefit accrual/cost.
   - Plan B has a more generous pensionable earnings definition - for any member who has a significant bonus pay, Plan B will be more costly.

2. Benefit Adequacy
   - Plan A has more generous plan provisions, thus Plan A would offer better pension benefits to members.
   - In the calculation in part (b), Plan A offers higher replacement ratio than B.
   - However if bonus represents a significant portion of the total pay, Plan A may not provide adequate replacement ratio.

3. Attraction/Retention
   - Plan A has more generous plan provisions, thus it provides more incentive to retain and attract employees, especially the accrual rate jumps to 7% after 10 years of service.
   - Plan A is especially more attractive to older employees who may have a shorter further service time to retirement. Plan A offers faster benefit accrual for such members. (i.e. appealing to mid-career hires).
   - Plan B includes bonus in its pensionable earnings definition. Plan B is more attractive for employees who have a significant portion of total pay as variable pay.

9. Learning Objectives:

1. The candidate will be able to analyze different types of registered/qualified defined benefit and defined contribution plans, as well as retiree health plans.

Learning Outcomes:

(1a) Describe the structure of the following plans:

- Fixed dollar and pay-related defined benefit plans
- Hybrid plan designs such as, cash balance, pension equity, and floor offset plans, target benefit plans
- Defined contribution plans including 401(k) plans and capital accumulation plans
- Retiree Health Plans

(1d) Given a plan type, explain the relevance and range of plan features including the following:

(i) Plan eligibility requirements
(ii) Benefit eligibility requirements, accrual, vest and phased retirement
(iii) Benefit/contribution formula
(iv) Payment options and associated adjustments to the amount of benefit
(v) Ancillary benefits
(vi) Benefit subsidies and their value, vested or non-vested
(vii) Participant investment options
(viii) Required and optional employee contributions
(ix) Phased retirement and DROP plans

Sources:

R-D 100-11 Multiemployer Plans

CIA Ed Note: Financial Risks Inherent in Multi-Employer Pension Plans and Target Benefit Plans

Handbook of Canadian Pension and Benefit Plans, 14th Ed, Ch. 1 – pages 15,21,22

Commentary on Question:

In this question, candidates were asked to demonstrate that they understood the design features of a Multi-Employer Pension Plan. Further, they were asked to provide some analysis of the advantages and disadvantages that would arise if NOC were to transfer their hourly employees to a MEPP.

A well prepared candidate would have been able to recall and summarize the information addressed in the two MEPP study notes.

This question was not well answered by candidates.

9. Continued

Solution:
National Oil Company (NOC) is considering joining a Multi-employer Pension Plan (MEPP) for future service for their Full-Time Hourly Employees.

(a) Describe the plan design characteristics of MEPPs.

Commentary on Question:
Part (a) asked candidates to show their knowledge of the plan design of MEPPs. Most candidates provided a memorized list of items regarding MEPPs. This list did not specifically address design issues and therefore missed many of the fundamental points while providing many irrelevant points. The prepared list was not adequate to show that the candidate understood MEPP design features or even the basic set up of a MEPP. We were looking for more detail. For example; how benefits are delivered, how service is determined, which plan features are common.
Further, many candidates provided a second list of discussion points regarding issues arising with MEPP valuations. This was not a question about valuing a MEPP. Therefore no points were credited for valuation concerns.

- A Multi-Employer Pension Plan (MEPP) is a plan sponsored by two or more non-affiliated employers within a related industry. Such a plan allows employees (ees) to remain in the plan when moving between participating employers (ers). MEPPs combine characteristics of DB and DC plans because plan experience directly affects the participants' benefits.

- Pension benefits are most commonly flat dollar plans where the benefit is defined as $/month x years of service. Another common design describes the pension benefit as a % of total lifetime contributions. Benefit amounts and employer contribution levels within plan may vary by er. Employer contributions are defined as a number of cents per hour worked or as a % salary.

- Benefit levels and employer contributions for each employer are determined by negotiation between the participating er and their union. Valuations are performed periodically to determine funding levels. Benefit levels are not guaranteed and may be reduced if plan funding levels are insufficient to cover current liabilities. Benefit changes may be required future, accrued, or all earned service.

- Service within a MEPP is credited for hours worked with any involved employer. Typically a minimum number of hours per annum is required. Most plans give extra credit for hours beyond the minimum required to achieve a full year of service. Some plans allow more than full year of credited service in one calendar year.

9. Continued

- MEPPs are governed by a board of trustees consisting of equal representation from the participating ers' management teams and the participants.

- Often MEPP plans will pay a full accrued benefit upon disability. Requirements for payment of this benefit include a minimum credited service and/or government benefits be in payment.

- Early Retirement Subsidies are not as common in MEPPs. Where they exist, a minimum number of points (age and service) will be required.

- In some MEPPs ees can continue to work and accrue service under another plan while collecting a benefit from the MEPP.

- Optional forms are typically only available on actuarially equivalent basis.

- Pensions in payment may pop-up to normal life-only form if spouse pre-deceases the participant.

(b) Discuss the advantages and disadvantages of joining a MEPP relative to the current Full-Time Hourly Union Pension Plan from the perspective of both NOC and the Hourly Employees.

Commentary on Question:
Candidates were aware of advantages and disadvantages of a MEPP. However, very few tailored their discussion to points relevant to NOC and its Hourly Plan's particular situation. Candidates were expected to consider and use the details of NOC's Hourly plan and its demographics in their response. Credit was awarded for points which were relevant to this situation. For example, few people remarked that early retirement subsidies and guaranteed post retirement indexing would likely not be available in a MEPP, disability benefits would likely be more generous in a MEPP.

Advantages for NOC

- Less administrative burden (if now doing it themselves) because admin done by plan
- ER has reduced governance role
- Accounting is simpler : pension expense = cash contributions
- Contributions are negotiated so costs are predictable over the course of the contract
- May experience a gain on investment return because larger assets under management
- Economies of scale – reduced; valuation costs, investment manager costs

9. Continued

- ER bears less funding risk because benefits can be decreased to offset bad funding level
- ER responsibility for funding is limited to contributions (no special payments)
- Strengthened ties with union since they must work jointly to provide reasonable benefits
- Ees share in responsibility for retirement wealth and appreciate benefit more

Disadvantages for NOC

- Investments tend to be more conservative so require larger contributions over long haul
- Less control over plan communication and ee appreciation of pension benefit after change
- If the employer later chooses to withdraw from the plan – could incur significant costs in litigation

Advantages for NOC employees

- Plan members more involved in plan management because they are required to be trustees
- Disability benefits may be more generous
- Decreased risk of er failure affecting pension benefits
- Union has more power to negotiate pension benefits
- Risks spread more broadly over all plan members - all employers, actives, retirees, TVs
- More continuous credited service - full benefit portability within participating ers

Disadvantages for NOC employees

- Vesting may take longer if MEPP plan vesting is not immediate
- May lose guaranteed post retirement increases
- Benefit levels not guaranteed and may decrease
- May lose early retirement subsidy if MEPP plan is not as generous
- Increased sensitivity to overall and industry economy- risk of benefits being reduced at same time as work hours available being reduced

10. Learning Objectives:

10. The candidate will be able to analyze the relationship of plan investments with plan design and valuations.

Learning Outcomes:

(10c) Given a context, describe and compare the structure of appropriate investment vehicles.

Sources:

Chapter 8 – Maginn and Tuttle, Section 6 – Hedge Funds

Commentary on Question:

In this question, candidates were asked to explain the issues with using and selecting hedge fund indices, as well as describe and contrast two hedge fund strategies.

In part (a), the candidate was asked to describe the key issues with using and selecting hedge fund strategies. Candidates were expected to name the majority of the key issues described in the reference material, as well as provide a brief description of each issue. In part (b), candidates were required to describe and compare two specific types of hedge fund strategies. Candidates were expected to be able to describe the defining features of each strategy, and describe the differences between the two strategies.

Solution:

(a) Your client has added hedge funds to their pension plan's investment portfolio. In order to monitor the investment performance of these funds, your client is considering using hedge fund indices.

Describe the key issues with using and selecting hedge fund indices.

Commentary on Question:

For part (a) a well prepared candidate would have been able to provide and describe all five issues with selecting hedge fund indices. A poorer performing candidate would not be able to describe or list all issues, or would have only described hedge funds in general or issues with hedge funds, not hedge fund indices.

Biases in index creation – The main issue with hedge fund indices is that the databases are self-reported, and the manager chooses which databases to report and provides the return data. Also, weighing schemes may affect the correlation between similar strategy indices.

10. Continued

Relevance of Past Data on Performance – the volatility of returns is more persistent through time than the level of returns. Research shows that the best forecast of future returns is one that is consistent with prior volatility, not one that is consistent with prior returns. However, the composition of hedge fund indices changes greatly, so the past returns of an index reflect the performance of a different set of managers from todays or tomorrows managers.

Survivorship Bias – This happens when managers with poor track records exit the business and are dropped from a database. Thus only managers with good records remain and results in an over-estimation of historical returns.

Stale Price Bias – This is caused by a lack of security trading in asset markets. When securities have stale prices, their measured correlations may be lower than expected.

Backfill or Inclusion Bias – Results when missing past return data for a component of an index are filled at the discretion of the component when it joins the index. This makes results look too good because only components with good past results will be motivated to supply them (like survivorship bias).

(b) Compare and contrast the following hedge fund strategies:

(i) Merger Arbitrage.

(ii) Hedged Equity.

Commentary on Question:
The well prepared candidate would have been able to provide the accurate and relevant detail on each strategy. For Merger arbitrage, the prepared candidate would indicate that it is event driven and that a manger takes advantage of the event, as well as a description of how they would do that. For the Hedged Equity strategy, a well prepared candidate would have indicated that the manager would attempt to identify over and undervalued equity securities, and take advantage of this by taking long or short positions on said equity. A poorer performing candidate would not have been able to describe the strategy, or provide descriptions for other strategies or descriptions based on the name of the strategy. [Some more details on the answers to the strategies would help – commentary is still too general].

10. Continued

Merger Arbitrage captures the price spread between current market prices of corporate securities and value upon successful completion of takeover, merger, spin-off or similar transaction involving more than one company.
Hedged Equity is an investment strategy in which the managers also attempt to identify overvalued and undervalued equity securities. However, the key difference is the portfolios are not structured to be market, industry, sector and dollar neutral, and they may be highly concentrated in the long or short positions and the portfolio may have a net long exposure to the equity market. It is also the largest of the hedge fund strategies in terms of assets under management, thus there are more opportunities to use this strategy.

11. Learning Objectives:

2. The candidate will be able to understand how the regulatory environment affects plan design and understand how to apply relevant restrictions.

8. The candidate will be able to evaluate the actuarial considerations in plan options and administration.

Learning Outcomes:

(2a) Explain and apply the regulatory limits placed on types of plans that can be offered.

(8b) Assess the impact of applicable regulation, including:
- Commuted value standard

Sources:

Canadian Pensions and Retirement Income Planning, 4th edition – Chapter 17

CSOP 3000 – Pension Commuted Values

Commentary on Question:

In this question, candidates were asked to demonstrate the application of limits imposed by the Income Tax Act on permissible benefits from registered pension plans.

A well prepared candidate would have been able to apply all limits imposed by the Income Tax Act to determine a member's lifetime and temporary bridge benefit entitlements payable from a registered pension plan.

Many candidates referred to grow-in in their answers to this question. However, providing grow-in was irrelevant to this question as there was no mention to calculate a benefit upon wind up or involuntary termination (in addition, grow-in upon involuntary termination was not in the syllabus of this exam). Instead, according to actuarial standards of practice upon member termination, it is reasonable to assume that the member will act so as to maximize the value of the benefit, i.e., the option that has the greatest value would be used in the determination of the commuted value. It is given in the text of this question that the candidate can assume the maximum commuted value occurs at age 55 and therefore the candidate was not required to determine the "best age."

Almost all candidates calculated the plan lifetime pension and applied the appropriate plan early retirement reduction correctly (a few candidates used incorrect years of credited service when determining the accrued pension).

Most candidates overlooked projecting ITA limits and government benefit elements (such as CPP, OAS, and YMPE) with CPI or AIW, as appropriate for purposes of calculating the bridge pension under the plan formula, ITA lifetime pension limit, ITA bridge limit, and the ITA combined lifetime and bridge limit.

11. Continued

Most candidates did well in determining the earliest unreduced age under ITA provisions; however some candidates incorrectly used credited service as opposed to continuous service in their calculations.

It is encouraged that candidates show all work when applying tests for limits imposed by the ITA to fully demonstrate their understanding of how the limits are to be applied. While some candidates demonstrated their understanding of how the maximum bridge limits are applied, others net the ITA lifetime pension limit from the ITA combined limit as opposed to netting the pension under the plan provisions when applying the maximum bridge test.

Candidates who scored well on this question demonstrated their understanding by writing out all formulas correctly (and subbed in the correct numbers) for the ITA limits; for ITA early reduction factors (including formulas for determining the earliest unreduced age used to determine the ITA lifetime limit reduction factor); and for all limit tests that were applied.

Candidates who did not score well on this question did not write out or apply correct formulas, used incorrect inputs (for example used credited service instead of continuous service in their calculations and vice versa), provided multiple calculations for certain parts of this question that were inconsistent with each other, and/or failed to consider all ITA limits (for example, performed calculations for the ITA lifetime pension and the ITA bridge limit, but did not mention the ITA combined lifetime and bridge limit.

Solution:
Calculate the commuted value assuming the member terminated on January 1, 2012. Assume the maximum commuted value occurs at age 55.

Plan Formula Lifetime:
Accrued annual lifetime pension (without reduction)
= 2% x best average earnings x credited service
= 2% x 200,000 x 7
= 28,000

Plan Lifetime Reduced for Early Retirement:
= annual pension x minimum (1 - 0.5% x 12 x (62 - assumed retirement age), 1)
= 28,000 x minimum (1 - 0.5% x 12 x (62-55), 1)
= 28,000 x 0.58
= 16,240

11. Continued

Plan Formula Bridge:
UNDER METHOD 1:
The plan bridge is the maximum CPP at the assumed retirement age of 55; maximum CPP is defined as 25% x AYMPE5. The YMPE used for this calculation should be projected using the AIW increase assumption (AIW increase assumption is: CPI + 1% = 2% + 1% = 3%).

Annual temporary bridge pension
= projected annual CPP benefit
= 25% x AYMPE5
= 25% x ($YMPE_{2020}$ + $YMPE_{2019}$ + $YMPE_{2018}$ + $YMPE_{2017}$ + $YMPE_{2016}$) / 5
= 25% x 50,100 x [$1.03^{(55-47)}$ + $1.03^{(55-47-1)}$ + $1.03^{(55-47-2)}$ + $1.03^{(55-47-3)}$ +$1.03^{(55-47-4)}$] / 5
= 14,968.58

UNDER METHOD 2:
The plan bridge is the maximum CPP at the assumed retirement age of 55; maximum CPP at assumed retirement date should be projected with given CPI rate of 2%.

Annual temporary bridge pension
= projected annual CPP benefit
= current monthly CPP x 12 x $(1+CPI)^{(\text{assumed retirement age - current age})}$
= 986.67 x 12 x $1.02^{(55-47)}$
= 13,872.49

ITA Lifetime Limit:
The ITA lifetime limit should be projected to the assumed retirement age of 55 using the AIW increase assumption (AIW increase assumption is: CPI + 1% = 2% + 1% = 3%).

Maximum annual lifetime pension (without reduction)
= minimum (2% x FAE3 projected with AIW, dollar limit projected with AIW) x credited service
{note: the 2% limit will not apply in this case}
= current dollar limit x $(1+AIW)^{(\text{assumed retirement age - current age})}$ x credited service
= 2,646.67 x $1.03^{(55-47)}$ x 7
= 3,352.72 x 7
= 23,469.04

Reduced ITA Lifetime Limit:
ITA lifetime early reduction factor (3% per year from earliest of 30 years of service / 60 years of age / 80 points) is applied to the ITA lifetime pension only at the assumed retirement age of 55.

11. Continued

Earliest unreduced age under ITA provisions
= minimum (current age + 30 - current continuous service, age 60, (80 points - current age - current continuous service)/2 + current age)
= minimum (47+30-9, 60, (80-47-9)/2+47)
= minimum (68, 60, 59)
= age 59

ITA reduction applied to ITA lifetime limit
= 3% x (earliest unreduced age under ITA provisions - assumed retirement age)
= 3% x (59-55)
= 12%

ITA annual lifetime pension with early reduction factor
= lifetime limit x (1 - ITA reduction)
= 23,469.04 x (1-12%)
= 20,652.76

Maximum Lifetime Pension at age 55
= minimum (plan lifetime pension with plan reduction, ITA lifetime pension with ITA reduction)
= minimum (16,240.00, 20,652.76)
= 16,240.00

Therefore, the lifetime benefit from the plan is not limited by ITA limits.

ITA Bridge Limit
The OAS pension used for this calculation should be projected to assumed retirement date with the given CPI rate of 2%.

Projected OAS pension
= current monthly OAS pension x 12 x $(1+CPI)^{(\text{assumed retirement age - current age})}$
= 540.12 x 12 x $1.02^{(55-47)}$
= 7,594.04

The projected CPP pension was calculated under the Plan Formula Bridge section above.

<u>UNDER METHOD 1:</u>
ITA bridge limit
= (Projected CPP x minimum (1, HAE3/YMPE3) + projected OAS) x minimum (1, credited service / 10) x minimum (1, 1 - 0.25% x 12 x (60 - assumed retirement age))
= (14,968.58 x 1 + 7,594.04) x minimum (1, 7/10) x minimum (1, 1 - 0.25% x 12 x (60-55))
= 13,424.76

11. Continued

UNDER METHOD 2:
ITA bridge limit
= (Projected CPP x minimum (1, HAE3/YMPE3) + projected OAS) x minimum (1, credited service / 10) x minimum (1, 1 - 0.25% x 12 x (60 - assumed retirement age))
= (13,872.49 x 1 + 7,594.04) x minimum (1, 7/10) x minimum (1, 1 - 0.25% x 12 x (60-55))
= 12,772.59

ITA Combined Lifetime and Bridge Limit
The AYMPE3 used for this calculation is the average of $YMPE_{2020}$, $YMPE_{2019}$, and $YMPE_{2018}$; the YMPE should be projected using the AIW increase assumption (AIW increase assumption is: CPI + 1% = 2% + 1% = 3%).

ITA combined lifetime and bridge limit
= projected dollar limit x credited service + 25% x projected AYMPE3 x (credited service) / 35
= 3,352.72 x 7 + 25% x [50,100 x ($1.03^{(55-47)}$ + $1.03^{(55-47-1)}$ + $1.03^{(55-47-2)}$) / 3] x 7 / 35
= 26,550.77

Maximum Bridge Payable
UNDER METHOD 1:
Maximum bridge payable
= minimum (bridge under plan, bridge limit, combined limit - pension under plan)
= minimum (14,968.58, 13,424.76, 26,550.77 - 16,240)
= minimum (14,968.58, 13,424.76, 10,310.77)
=10,310.77

UNDER METHOD 2:
Maximum bridge payable
= minimum (bridge under plan, bridge limit, combined limit - pension under plan)
= minimum (13,872.49, 12,772.58, 26,550.77 - 16,240)
= minimum (13,872.49, 12,772.58, 10,310.77)
=10,310.77

Total Commuted Value Calculation
= annual lifetime pension payable x ${}_{55-47|}\ddot{a}_{47}$
+ annual bridge pension payable x ${}_{55-47|}\ddot{a}_{47:65-55|}$
= 16,240 x 9.3 + 10,310.77 x 4.8
= 200,524

12. Learning Objectives:

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

Learning Outcomes:

(6a) Evaluating actual experience, including comparisons to assumptions.

(6c) Evaluate appropriateness of current assumptions given the purpose.

(6e) Describe and apply the building of economic assumptions.

(6f) Assess and explain the effect that the assumptions selected had on valuation results.

Sources:

Yamamoto Ch 9 pp 256 – 278

R-D112-10: 2009 Selection of Actuarial Assumptions, Mercer

R-D614-11: CSOP 3100-3500, December, 2010

R-D130-09: ASOP 23 – Data Quality

Commentary on Question:

This question is broken up into 4 parts. Part (a) of the question asks the candidate to demonstrate their understanding of the steps required in an experience study (Learning Outcome 6(a)). A well prepared candidate will be able to list the major steps in an experience study with some additional discussion on the data collection process.

Part (b) asks the candidate to demonstrate their understanding of important factors to consider while performing an experience study (Learning Outcome 6(a)). A well prepared candidate will discuss types of assumptions analyzed, data considerations, assumptions specific to subgroups, external factors that may impact the experience study, plan provisions, format of assumptions and credibility of results.

Part (c) asks the candidate to demonstrate their understanding how the three types of assumptions affect a pension valuation (Learning Outcome 6(f)). A well prepared candidate will be able to comment on how the assumption change impacts the pension liabilities on a going concern and solvency basis, as well as normal cost and gains and losses from the valuation. A well prepared candidate should also be able to give a brief summary of the quantitative impact on the liabilities from these assumption changes.

Part (d) asks the candidate to demonstrate their understanding how assumptions have different impact for a pension plan versus retiree medical plan (Learning Outcome 6(f)). A well prepared candidate should recognize and explain that termination and retirement scale has a bigger impact on retiree medical plans.

12. Continued

Solution:

a) List the steps to perform an experience study for pension and retiree medical plans.

The steps to perform an experience study are as follows:

Step 1. Identify the assumptions to be reviewed
Step 2. Collect data
  Determine time period to be reviewed
  Determine which of data fields are required (salary, DOB, service etc)
Step 3. Review data for reasonableness and quality (ASOP 23)
Step 4. Compare actual experience versus assumptions
Step 5. Analyze results
  Should analyze results in combination with liabilities gains/losses in past valuations
  Should adjust for any special events during study period
Step 6. Present results and make recommendations as appropriate
  May go back to client and request more data if original data provided not adequate

(b) Describe the considerations when performing an experience study for the following assumptions for NOC's defined benefit pension and retiree medical plans:

(i) Retirement
(ii) Turnover
(iii) Mortality
(iv) Trend rates

(i) Retirement

Considerations for when performing an experience study for the retirement assumptions are as follows:

- Amount of data required
  - Plan is relatively young but enough experience to be credible
- Types of retirement assumptions to be used
  - Current assumption is single age of 62
  - Single age versus table: if actual retirements are occurring at different ages, may be more appropriate to use table
- Consider using different retirement assumptions for different groups
  - Active members versus deferred vested members
    - Deferred vested members are entitled to actuarial equivalent benefits; different incentives to retire
  - Open group versus closed group

12. Continued

- Consider how plan provision may impact retirement assumptions
  - Early retirement subsidy may encourage early retirements
- Consider how special events may impact retirement assumptions
  - Were there any early retirement windows
  - Are any special events expected to continue into the future
- Consider how external factors may impact retirement assumptions (this point applies to all four assumptions)
  - Current economic conditions
  - Financial strengths of the company
- Consider how eligibility for retiree medical plan affect retirement
- Retirement assumptions have larger impact on retiree medical plan than pension plan
- Consider how Retirement assumptions is related to termination assumption
  - Typically retirements aren't assumed to occur till after termination rates end
- Consider how results of the experience study tie back to the gains/losses from the valuation results (this point applies to all four assumptions)

(ii) Turnover

Considerations for when performing an experience study for the retirement assumptions are as follows:

- Types of turnover assumptions to be used
  - Age based table or service based table
  - Select and ultimate table
- Consider using different turnover assumptions for different groups
  - Gender
  - Salaried versus hourly workers
- Consider how plan provision may impact turnover assumptions
  - Vesting provision: low turnover before vesting eligibility
- Consider how special events may impact turnover assumptions
  - Were there any workforce reductions and are any expected in the future

(iii) Mortality

Considerations for when performing an experience study for the mortality assumptions are as follows:

- Amount of data required
  - Plan does not have enough data to develop own table
  - Should use published table such as UP1994 or RP2000
- Adjustments to the published table
  - Mortality improvements: static table versus generational improvements

12. Continued

- Collar adjustments: blue and white collar
- Consider using different retirement assumptions for different groups
  - Healthy lives versus disabled lives
  - Different mortality table for pre and post retirements
- Mortality assumptions have larger impact on retiree medical plan if there are benefits related to mortality such as life insurance benefits

(iv) Trend rates

Considerations for when performing an experience study for the trend assumptions are as follows:

- Only used for the retiree medical plan
- Consider how past conditions (medical advances) affected data used in the study
- Consider how future medical advances will affect assumption
- Types of assumptions to be used: select and ultimate

(c) Describe, in words, the impact of each assumption change to the January 1, 2012 pension valuation results for the Full-Time Salaried Pension Plan.

(i) Salary scale

- Increasing the salary scale assumptions for under age 35 would increase the going concern liability since it is valued using projected unit credit method.
- Increasing salary scale assumption would also increase the normal cost.
- There is no impact on the solvency liability .
- Members under age 35 would have less service therefore lower liabilities. Changing this assumption would have a small impact on the total liabilities.
- The percent increase to normal cost would be higher than the percent increase in total liabilities.
- Numerical example on impact on an individual's liabilities: e.g. for someone aged 30, increasing the salary scale from 4% to 6% for 5 years (till age 35) will be around 10%.
- If there were historical salary gain in past valuations, then the gain will be reduced for the next valuation by increasing the salary scale assumption.

(ii) Turnover

- Changing the turnover assumptions would lower the going concern liability and normal cost.
  - Some members will not reach vesting.

12. Continued

- Some members will not get to remain in plan till eligible for subsidized early retirement.
- Changing the turnover assumptions would have no impact on the solvency liability.
- If there were historical termination gains in past valuations, then the gain will be reduced for the next valuation.

(iii) Retirement

- Current assumption is 100% retirement at age 62 which is the unreduced age.
- Changing the assumed retirement age from 62 to 64 would lower the going concern liability.
  - Members are not taking advantage of the unreduced early retirement subsidy.
- Changing the retirement age would decrease normal cost for those under age 62.
- Change the retirement age would increase normal cost for those between age 62 and 64 (where previously normal cost for them was zero).
- Gains and losses from retirements do not occur until the earliest assumed retirement age. May not see impact of assumption change till later in the future.

(d) Describe, in words, the difference in sensitivity of the liabilities to the above assumption changes between the Full-Time Salaried Pension Plan and the Full-Time Salaried and Union Retiree Health Benefit Program.

(i) Salary scale

- The retiree medical plan benefits are unrelated to the salary assumption, therefore the liabilities for the retiree medical plan are not sensitive at all to the salary scale.

(ii) Turnover

- The liabilities of the retiree medical plan are much more sensitive to the turnover assumption.
  - Terminated members (vested) are still entitled to their benefits in a pension plan.
  - Members must reach 55&10 in order to receive benefits from the retiree medical plan; therefore if any members terminated before meeting those requirements would not get any benefits.

12. Continued

(iii) Retirement

- The liabilities of the retiree medical plan are much more sensitive to the retirement assumption.
- Retirees under age 65 receive a much bigger benefit (therefore higher liabilities) than retirees over age 65.
  - Retirees under age 65 receive benefits for longer period.
  - There is government carve-out in pre 65 retiree medical benefits (such as Medicare in the US).

13. Learning Objectives:

1. The candidate will be able to analyze different types of registered/qualified defined benefit and defined contribution plans, as well as retiree health plans.

8. The candidate will be able to evaluate the actuarial considerations in plan options and administration.

Sources:
R-D145-12 :Legal and Research Summary Sheet: Phased Retirement, Georgetown Law

Commentary on Question:
In this question, candidates were asked to demonstrate their understanding of various types of phased retirement arrangements and how they would benefit the employee and employer and what challenges are faced under each arrangement.

A well prepared candidate described employee benefits, employer benefits and employee/employer challenges for all three arrangements. The well prepared candidate also demonstrated their understanding of the differences between the various phased retirement methods.

In general, candidates did poorly on this question. Candidates that performed the best on this question looked beyond just the pension plan implications of a phased retirement and were clearly familiar with the Georgetown Law: Legal and Research Summary Sheet on phased retirement from the syllabus material.

Solution:
Describe the benefits and the challenges of each arrangement from both the employees' and employer's perspective.

PARTICIPANT A: elected to commence partial pension payments and is continuing to work for your client on a part-time basis

Commentary on Participant A
On average, candidates scored best on their responses for Participant A. Most candidates identified that pension calculations could be complicated under this type of arrangement, that the employer would benefit from retaining an experienced employee and that there would be an administrative burden associated with this arrangement. However, only a small group of candidates identified some implications beyond the pension plan implications, such as the employee possibly being eligible for employer sponsored benefits and other legal implications.

13. Continued

Employee Benefits

- The employee can work less, while their lost employment income is replaced with partial retirement income.
- The employee may still be eligible for employer sponsored benefits, depending on the amount of reduction in their work schedule.

Employer Benefits

- Similar to participants B & C, the employer is retaining talent by continuing to employ the experienced employee and will continue to benefit from their expertise and knowledge without having any additional training expenses.
- The employer is also able to postpone searching for new talent.
- This arrangement gives the employer an opportunity to extend the labor force participation of their older workers.

Challenges for both employee and employer

- As this employee has retired under a phased retirement arrangement where they are receiving partial pension payments and are continuing to work, it will be more complicated to calculate this employee's final pension benefit when they choose to fully retire.
- The reduction in hours due to part-time employment status could impact accruals under the plan and could equate to a reduction in final pension for final average DB plans.
- The impact on spousal survivor benefits and early retirement subsidies must be considered. Any employer sponsored life and disability insurance based on compensation could be reduced.
- The reduction in hours due to part-time employment status could also impact the employee's eligibility for employer-sponsored health care and other employee benefit plans.
- The impact on eligibility for government sponsored benefits must also be considered. For example, Medicare as a Secondary Payor rules are unclear as to whether the employer sponsored health care plan or Medicare would be the primary plan for individuals over age 65, if the employee is eligible for retiree health care coverage instead of active health care coverage.
- One of the main legal issues relating to phased retirement is under what circumstances an individual may access pension or retirement funds to supplement part-time income. For example, current US tax laws do not permit a distribution from a pension plan before full termination, age 62 or reaching the plan's normal retirement age. Furthermore, employee elective deferrals under Code Section 401(k) may not be distributed before termination of employment or age 59 & 1/2.
- Employers may be exposed to potential lawsuits that result from a formal phased retirement program.
- Additional pension plan administrative burden and/or additional HR burden may result from a formal phased retirement program.

13. Continued

PARTICIPANT B: Elected to commence full pension payments and is continuing to work for your client on a full-time basis

Commentary on Responses for Participant B
Most candidates identified that the employer would benefit from retaining an experienced employee and that there would be administrative burden associated with this arrangement. However, only a small group of candidates identified that the employee would be eligible for the same employer sponsor benefits that are available to other full-time employees and there would be a possibility that the employee's pension benefits could be suspended while working full time.

Employee Benefits
- The employee is still eligible for all employee benefits available to other full-time employees.

Employer Benefits
- Similar to participants A & C, the employer is retaining talent by continuing to employ the experienced employee and will continue to benefit from their expertise and knowledge without having any additional training expenses.
- The employer is also able to postpone searching for new talent.
- This arrangement also gives the employer an opportunity to extend the labor force participation of their older workers.

Challenges for both employee and employer
- This is a less flexible phased retirement arrangement.
- It is possible that pension benefits may be suspended while working full time.
- If the employee is over age 65 then employer's active health care plan will be primary plan over Medicare
- Employers may be exposed to potential lawsuits that result from a formal phased retirement program
- Additional pension plan administrative burden and/or additional HR burden may result from a formal phased retirement program.

PARTICIPANT C: Elected to commence full pension payments and has been hired by your client as an independent contractor.

Commentary on responses for Participant C
Most candidates identified that the employer would benefit from retaining an experienced employee and that there would be administrative burden associated with this arrangement. However, only a small group of candidates identified that the employee's pension benefit would most likely not be suspended, that the employee has to deal with their own employment taxes and that the employer has the luxury of retaining the employee on a "need-to-have basis".

13. Continued

Employee Benefits

- Employee's pension benefit is most likely not suspended due to contract employment status

Employer Benefits

- Similar to participants A & B, the employer is retaining talent by continuing to employ the experienced employee and will continue to benefit from their expertise and knowledge without having any additional training expenses.
- The employer is also able to postpone searching for new talent.
- This arrangement also gives the employer an opportunity to extend the labor force participation of their older workers.
- Employer is not responsible for employee's employment taxes due to contract employment status.
- Able to retain employee talent and experience on a "need-to-have" basis (also have the flexibility to negotiate terms of a contract).

Challenges for both employee and employer

- Employee is not eligible for employer sponsored benefits due to contract employment status.
- Employee is responsible for all employment taxes.
- Tax laws may be unclear. For example, it may be unclear as to when or whether such arrangement is a termination of employment for purposes of receiving a pension or retirement benefit.
- Health coverage may not be bridged until Medicare eligibility.
- Must meet certain requirements to be considered an independent contractor and not an employee.
- Employers may be exposed to potential lawsuits that result from a formal phased retirement program.
- Additional pension plan administrative burden and/or additional HR burden may result from a formal phased retirement program.

14. Learning Objectives:

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

Learning Outcomes:

(5b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using the variety of cost methods for budgeting, funding accounting and measuring economic value.

(5e) Assess the impact of using cost methods in a given context.

Sources:

Pension Mathematics for Actuaries, Anderson, Third Edition, 2006, Chapter 2.

Commentary on Question:

A well prepared candidate will be able to calculate normal costs using the Entry Age Normal and Frozen Initial Liability cost methods. They will also be able to determine the impact of changing retirement assumptions.

Generally, candidates did quite well on this question, especially on part (a). However, some candidates answered little or none of part (b). The majority of the points were granted for the normal cost and liability formulas.

Solution:

(a) Calculate the contribution at January 1, 2012 under the following methods:

(i) Entry Age Normal

(ii) Frozen Initial Liability

Commentary on Question:

Overall, candidates performed quite well on this part of the question. Common errors involved failing to project the normal cost with salary increases or incorrectly calculating the final year's earnings.

(i) EAN AL= PVFB - $PVFNC_x$ [or alternate formulas]

EAN NC = $PVFB_w/PVFS_w$ x S_x

$PVFB_{30}$= .02*100,000 x $(1.04)^{25}$ x (65-30) x $\ddot{a}_{65}^{(12)}$ x v^{35}

= 186,609 *11*.1301

= 267,066

$\ddot{a}_{35\,\overline{j}}$ = $(1-v^{35})/(1-v)$=25.7894 where j = (1.04)/(1.06)

14. Continued

$PVFS_{30}$= 100,000 x $(1.04)^{-9}$ x $\ddot{a}_{35\square s}$
= 70,259*25.7894
= 1,811,929

EAN NC= 267,066/1,811,929 x 100,000 x 1.04
= 15,329

EAN AL= 478,275 – 15,329 * $\ddot{a}_{25\square j}$
= 170,474

UAL_0= 170,474

F_0= 0

Amort'n pmt= UAL_0 / $\ddot{a}_{15\square}$
= 170,474 / 10.295
= 16,559

EAN Contr'n = EAN NC + Amort pmt
= 15,329 + 16,559= 31,888

(ii) FIL AL_0= EAN AL_0
FIL NC= (PVFB – F – UAL) / $\ddot{a}_{(y-x)\ \square}$
FIL UAL_0= EAN UAL_0 = 170,474

$PVFB_{40}$= $PVFB_{30}$ x 1.06^{10}
= 478,275

FIL NC_{2010}= (478,275 – 0 – 170,474) / $\ddot{a}_{25\square j}$=
15,329

Amort'n pmt= UAL_0 / $\ddot{a}_{15\square}$
= 170,474 / 10.295
= 16,559

FIL Contr'n = FIL NC + Amort pmt
= 15,329 + 16,559= 31,888
(i.e. same for both methods at time 0)

(b) Determine the impact on (a)(i) of changing both the normal retirement age and retirement age assumption to age 60.

14. Continued

$PVFB_{30}$= .02*100,000 x $(1.04)^{20}$ x (60-30) x $\ddot{a}_{60}^{(12)}$ x v^{30}
= 131,467 *12*.17411
= 274,678

$\ddot{a}_{30\overline{|}j}$ = $(1-v^{30})/(1-v)$=23.0705 where j = (1.04)/(1.06)

$PVFS_{30}$= 100,000 x $(1.04)^{-9}$ x $\ddot{a}_{30\overline{|}s}$
= 70,259*23.0705
= 1,620,903

EAN NC= 274,678/1,620,903 x 100,000 x 1.04
= 17,624

$PVFB_{40}$= $PVFB_{30}$ x 1.06^{10}
= 491,906

EAN AL= 491,906 – 17,624 * $\ddot{a}_{20\overline{|}j}$
= 195,997 = UAL_0

Amort'n pmt= UAL_0 / $\ddot{a}_{15\overline{|}}$
= 195,997 / 10.295
= 19,038

EAN Contr'n = EAN NC + Amort pmt
= 17,624 + 19,038 = 36,662

Impact = 36,662 – 31,888 = 4,774