DP-RC Complete Illustrative Solutions
Fall 2009

1.

Learning Objective:
The candidate will be able to analyze data for quality and appropriateness

Source: ASOP 23,CIA CSOP 1000-1800

Commentary from Graders:
This question was intended to ensure candidates understand the professional standards for assessing data quality.

Question:
Describe how to ensure that the membership data is sufficient and reliable.

Solution:

(a) Follow ASOP 23 and CSOP 1530
- Use professional judgment to decide if review is needed and practical
  - Yes, since new client
- Identify the data needed/Selection of data
  - Review plan design
  - Discuss scope of project(s) with client
  - Consider elements that are desired
  - Other data available?
    - Cost and feasibility of obtaining alternative data
    - Benefit gained from alternative data
  - Method used to gather the data (sampling?)
- Attempting to obtain the data
- Review the data obtained
  - Procedure, controls and qualifications of those involved in putting together data
  - Is the data current?
  - Known limitations?
  - Significant events that may impact census data
  - Review of definitions of data elements that were provided
    - Appropriateness for intended purpose
    - Consistency with plan provisions
    - Data elements desired but not provided
  - Any independent confirmation of data available?

- Assessing sufficiency and reliability of the data

1. Continued

Identify aspects of the data that have largest impact on results
Check for reasonableness and comprehensiveness of data
Identify missing or incomplete data
Compare versus a prior data file for consistency
Check certain fields did not change (DOB)
Check certain fields changed as expected (Service)
Check certain fields changed in a reasonable manner (earnings)
Perform a membership reconciliation to ensure that all members are accounted for
Check current data for internal consistency
Confirm with client that all significant events have been reflected in census data
Establish approach for data corrections
Make assumptions where data is not available
Ask client to provide missing information or data queries

Question:

Itemize what should be included in your communication of the valuation results to the plan sponsor, as it relates to the membership data.

Solution:

(b) Follow ASOP 23, ASOP 41 and CSOP 1530
Use professional judgment if data is sufficient and reliable
If data is sufficient and reliable
Report an opinion without reservation on the data
If the data is defective, but not so as to negate the usefulness of the results
Report an opinion with reservation which
Describes the defects
Describes the work done and assumptions made to cope with the defect
And if practical, quantify the effect of the defect.
If the data is defective as to preclude a useful result
Actuary makes no report, or
Report an opinion with reservation which
Describes the defects
Describes the work done and assumptions made to cope with the defect
And if practical, quantify the effect of the defect.
Should disclose the following
Data source
Whether or not the data has been reviewed
Process followed to review the data
Whether review considered other data (prior year data)
Reliance on the data provided
Material defects with data

1. Continued

- Adjustments or assumptions made by the actuary
  - Rationale for adjustments
- Limitations due to uncertainty of the data
- Any unresolved concerns
- Results that are highly uncertain or have a potential bias
  - Nature of such uncertainty or bias
  - Magnitude of such uncertainty or bias
- Conflicts that arose from complying with law, regulation or binding authority.
- Justify deviations from ASOP 23

Other possible disclosures

- Description or summary of data
- Census date

2. Learning Objective:

Analyze/synthesize the factors that go into selection of actuarial assumptions for post-retirement medical plans

(a) Understand the various assumptions required for a valuation
(b) Evaluate appropriateness of current assumptions given the purpose
(c) Describe and apply the building of economic assumptions

Source:

Yamamoto Ch 9 pp 252-278 B
SOA Long Term Healthcare Trends Resource Model, Practical Issues for Actuaries

Commentary from Graders:

(a) This question tests the candidate's understanding of the roles assumptions play in a post-retirement medical plan and the care in their selection. A well prepared candidate will not only identify the relevant economic assumptions utilized in a retiree medical valuation but also their uses and the considerations in their selection.

(b) This question requires the candidate to apply the theoretical knowledge from part (a) to a real situation. A well prepared candidate would provide concrete opinions on the proposed trend rate, the inappropriateness of the client's basis for its selection and suggest appropriate model for the selection of a trend rate.

Question:

You are the actuary for a company that sponsors a retiree health benefit program.
(a) Describe the economic assumptions for retiree medical valuations and unique considerations for their selection.

Solution:

Discount Rate

Interest assumption used to discount future payments
Consist of inflations plus real rate of return / building block approach
Cash flow match of current high quality fixed income securities
Will differ from pension plan due to difference in cash flow
Should use after-tax rate of return on assets if plan is funded

Inflation

Base for all economic assumptions
Use CPI or other index

Salary Scale

- only if contributory or life insurance tied to salary

2. Continued

Plan Costs

projection of current cost of the retiree medical plan
Consider effects of aging
significantly impacted by plan design components:
> covered benefits
> deductible
> co pay
> retiree contributions
> out-of-pocket maximums
> integration with government provided health coverage or medicare/medicaid coverage
may develop costs for some benefits separately

Claims Cost (Data for Analysis)

Usually developed from claims paid during a given period
should develop cost active vs. pre-65 retirees vs. post-65 retirees separately
Missing data is often significant / databases may be unreliable / credibility of claims data
claims cost developed per capita
need to develop assumption of coverage election rate

Health Care Cost Trend Rate

Rate used to project current plan costs into future years
may vary short versus long term (select and ultimate effects)
may begin at current levels and trend down
long term rate often developed as inflation plus a real rate
Tied to GDP
Tied to provincial health coverage or medicare/medicaid coverage
consider health care inflation
consider advancements in technology
consider plan design effects / leveraging
consider cost shifting / retiree contribution rate change
consider utilization
consider usage mix of different health care services
may apply different trend rate to different services
consider sustainability of the trend in relation to the total economy. Cannot exceed 100% of GDP

All assumptions should be internally consistent
Assumptions should be developed in accordance with ASOP/CSOP

2. Continued

Question:

(a) Your client performed an internal study of active and retiree medical claim experience and concluded its costs have increased on average 3.5% per year for the past five years. The client suggests that a flat 3.5% per year would suffice as a Long-Term Health Care Trend Rate, as it reflects their experience and the fact that their employees tend to be healthier than average. Critique this suggestion, proving support for your opinion.

Solution:

3.5% trend rate is too low
Use of select and ultimate rates is common
Typically rates start high and trends lower
Higher for first 5 years is common
Consider relationship of Short Term Rates versus Projected Long Term Rates - must have consistent basis

Plan experience not a significant factor in Long-Term HCCTR
short rate consider plan experience
long rate driven by economy
constrained by GDP

Develop rate using SOA model (Getzen model) with following components
Rate of inflation
Rate of growth in real income/GDP per capita
Income multiplier for health spending
Extra trend due to technology and other factors
Health share of GDP resistance point
Year for limiting cost growth to GDP growth
Unique considerations of plan requiring changes to the typical pricing model
> legal constraints on future changes to the plan
> may require future health care costs be modeled without constraint limits
> regional legislative changes could impact future costs

3. Learning Objective:

This question was an analytical question which required the candidate to understand and apply Ontario funding rules and the contribution rules from the Income Tax Act. A passing candidate would have been able to correctly calculate the financial position of the plan under a going concern and solvency valuation using the Projected Unit Credit/Unit Credit actuarial cost method as well as translate these results into the correct minimum and maximum employer contributions for the year. Excess Surplus calculations were required as well as the consideration of established special payment schedules to ensure the minimum and maximum contributions were correct. This question addressed learning objective 5 b and d.

Source:

a. Pension Mathematics for Actuaries, Anderson, Third Edition; R-D612-09
b. Ontario Pension Benefits ACT RRO 1990, REg 909
c. Morneau Sobeco Handbook of Canadian Pension and Benefit Plans 14th Edition, Ch. 5
d. CIA Education Note – Assumptions for Hypothetical Wind-UP and Solvency Valuations with Effective Dates Between December 31, 2008 and December 30, 2009

Commentary from Graders:

Contained in the following solution.

Question:

(a) Calculate the going concern and solvency financial position of the plan as of January 1, 2009.

Solution:

Going concern financial position of the plan as at January 1, 2009:

Member A

The liability for member A is $0 since member A does not have any service

Member B

The liability for member B is determined as follows:

Liability member B = 2% * FAE_3 at 62 * service at Jan 1, 2009 * factor at 62 at 6.5% * (1-early retirement reduction) * discounting from age 62 to age 60.

Where:

- The FAE_3 at age 62 is determined as $(Sal_{61} + Sal_{60} + Sal_{59})/3$, where Sal_{61} is (1+salary increase assumption) * sal_{60}

  $FAE_3 = ((1.02) * 80{,}000 + 80{,}000 + 78{,}000)/3 = 79{,}867$

- Member B's service at Jan 1, 2009 is 30 years

3. Continued

- Factor at age 62 is 11.5
- The pension at age 62 is reduced for 3 years at 3% year, so the early retirement reduction is 9%.
- The discounting factor is determined as 1 / (1 + discount rate) ^2 = 1/1.065^2 = 0.8817

The liability for member B at Jan 1, 2009 is:

2% * 79,867 * 30 * 11.5 * (1-9%) * 0.8817 = $442,137

Total going concern liability:
The total going concern liability at Jan 1, 2009 is $0 + $442,137 = $442,137

Going concern financial position:
The market value of assets at January 1, 2009 is $600,000

The going concern financial position is determined as:

Assets at January 1, 2009 – liability at January 1, 2009 = $600,000 - $442,137 = $157,863 (surplus)

Solvency financial position of the plan as at January 1, 2009:

Member A
The solvency liability for member A is $0 since member A does not have any service

Member B
The solvency liability for member B is determined as follows:

The retirement age used to determine the solvency liability must be the age that maximizes the value of the benefits. Given the generous early retirement reduction, the age that maximizes the liability is the earliest age that members can retire. In the case of member B, that age is 60.

Liability member B = 2% * FAE_3 at 60 * service at Jan 1, 2009 * factor at 60 at 4.0% * (1-early retirement reduction)

Where:
- The FAE_3 at age 60 is determined as $(Sal_{59} + Sal_{58} + Sal_{57})/3$
  $FAE_3 = (78,000 + 78,000 + 78,000)/3 = 78,000$
- Member B's service at Jan 1, 2009 is 30 years

3. Continued

- Factor at age 60 is 15.2 (The discount rate to use for member B is the annuity purchase rate of 4% since member B is retirement eligible)

- The pension at age 60 is reduced for 5 years at 3% per year, so the reduction is 15%.

The liability for member B at Jan 1, 2009 is:

2% * 78,000 * 30 * 15.2 * (1-15%) = $604,656

Total solvency liability:
The total solvency liability at Jan 1, 2009 is $0 + $604,656 = $604,656

Solvency financial position:
The market value of assets at January 1, 2009 is $600,000

The solvency financial position is determined as:

Market value of assets at January 1, 2009 + solvency asset adjustment – wind-up expense – solvency liability at January 1, 2009

Solvency asset adjustment

The solvency asset adjustment is the present value of the already established special payment schedules for the next 5 years.

At the January 1, 2007 valuation, a going concern amortization schedule of $2,000 per year was established. However, given that plan has a surplus on a going concern basis at January 1, 2009, this schedule can be eliminated.

At the January 1, 2008 valuation, a solvency schedule of $8,000 per year was established. There are 4 years of payments left for this amortization schedule.

The present value of the solvency amortization payments at January 1, 2009 is determined as: $8,000 * a_4 , where $a_4 = (1- (1/1+i^{12}/12)^{\wedge 48)}/i^{12} = (1- (1/(1+0.045/12)^{\wedge 48)}/0.045 = 3.66$

The solvency asset adjustment is $8,000 * 3.66 = $29,287

The solvency financial position is $600,000 + $29,287 - $5,000 – $604,656 = $19,631 (surplus)

Question:

(b) Calculate the minimum required and maximum permitted employer contributions for 2009.

3. Continued

Solution:

To determine the minimum required and maximum permitted contributions for 2009, first determine the current service cost for members A and B

Current service cost member A

Current service cost for member A = 2% * FAE_3 at 62 * factor at 62 at 6.5% * (1-early retirement reduction) * discounting from age 62 to age 30 * survival probability.

Where:

- The FAE_3 at age 62 is determined as $(Sal_{61} + Sal_{60} + Sal_{59})/3$, where Sal_X is (1+salary increase assumption) $^{(X-30)}$*sal30
  $FAE_3 = ((1.02)^{31} * 50,000 + (1.02)^{30} * 50,000 + (1.02)^{29} * 50,000)/3 = 90,580$
- Factor at age 62 is 11.5
- The pension at age 62 is reduced for 3 years at 3% per year, so the early retirement reduction is 9%.

- The discounting factor is determined as 1 / (1 + discount rate) ^32 = 1/1.065^32 = 0.1333
- The survival probability is 0.9 since member A has 10% chance of terminating employment at the end of the first year of service

The current service cost for member A at Jan 1, 2009 is:
2% * 90,580 * 11.5 * (1-9%) * 0.1333 * 0.9 = $2,274

Current service cost member B

The current service cost for member B can be simply determined by dividing member B's January 1, 2009 going concern liability by the service at January 1, 2009:

Current service cost for member B = $442,137 / 30 = $14,738

Total current service cost

The total current service cost for 2009 is the sum of current service cost for members A and B = $2,274 + $14,738 = $17,012.

Special payments

Going concern special payments

There are no going concern special payments required since there is a surplus at January 1, 2009.

Solvency special payments

3. Continued

On solvency, the current solvency schedule is more than sufficient to fund the solvency deficiency at January 1, 2009 since there is a solvency surplus. If the solvency asset adjustment is excluded from the solvency financial position, there is a deficit of $19,631 - $29,287 = $9,656 (which is also equal to the wind-up shortfall at January 1, 2009).

Since the previous solvency amortization schedule is more than sufficient to fund this deficit, there is no need for a new solvency amortization schedule and the existing solvency amortization schedule must be shortened to just over 1 year. Therefore, the solvency amortization payment for 2009 is $8,000.

Minimum and maximum contributions

As at January 1, 2009, there is an excess surplus. Generally, when there is an excess surplus, the employer is not required nor permitted to contribute until the excess surplus is eliminated. However, given that the plan is not fully funded on a wind-up basis, the employer must contribute the current service cost and the solvency amortization payments.

The minimum required employer contribution for 2009 is:

Total current service cost + solvency amortization payment = $17,012 + $8,000 = $25,012.

The maximum permitted employer contribution for 2009 is:

Total current service cost + wind-up shortfall = $17,012 + $9,656 = $26,668

Question:

(c) During 2009, the company contributed the maximum permitted contribution on January 1, 2009, the fund earned 15%, salary increases were as assumed and Member B retired effective December 31, 2009. There were no other membership changes during the year. Calculate the going concern and solvency financial position of the plan as of January 1, 2010.

Solution:

Market value of assets

To determine the going concern and solvency financial position as at January 1, 2010, first determine the market value of assets at January 1, 2010:

MV of assets at January 1, 2010 = (MV assets Jan 1, 2009 + contribution) * (1 + actual return)

The employer contributed the maximum permitted amount of $26,668 on January 1, 2009 and the actual fund return during 2009 was 15%.

3. Continued

MV assets Jan 1, 2010 = ($600,000 + $26,668) * 1.15 = $720,668

Going concern financial position of the plan as at January 1, 2010:

Member A
Determine member A's going concern liability at January 1, 2010.

Member A's liability can be determined by projecting the 2009 current service cost with interest, adjusted for the fact that he did not terminate employment at the end of the year:

Member A's going concern liability = 2009 CSC * (1 + interest) / (1-termination probability)

Member A's going concern liability = $2,274 * (1 + 6.5%) / (1-10%) = $2,691

Member B
Member B is now retired. His actual annual pension is determined as:

2% * FAE_3 at 61 * service at January 1, 2010 * (1 - early retirement reduction)

Where:

- FAE_3 at 61 = (Sal_{60} + Sal_{59} + Sal_{58})/3 = ($80,000 + $78,000 + $78,000)/3 = $78,667
- The service at age 61 is 31 years
- The early retirement reduction is 3% for 4 years = 12%

Pension = 2% * $78,667 * 31 * (1-12%) = $42,921

The going concern liability for member B is the pension multiplied by the factor at age 61 using a 6.5% discount rate:

Member B's liability = $42,921 * 11.7 = $502,170

Total going concern liability
The total going concern liability at January 1, 2010 is $2,691 + $502, 170 = $504,861

Going concern financial position
The going concern financial position as at January 1, 2010 is MV assets – total liability =
$720,668 – $504,861 = $215,807

Solvency financial position of the plan as at January 1, 2010:

3. Continued

Member A
Member A's solvency liability at January 1, 2010 is determined as:

Liability member A = 2% * FAE_3 at 31 * service at Jan 1, 2010 * factor at 55 at 4.5% * (1-early retirement reduction) * discounting from age 55 to age 31

Where:

- The FAE_3 at age 31 is $50,000 since there is only 1 year of earnings
- Member A's service at Jan 1, 2010 is 1 year
- The discount rate to use for member A is the annuity purchase rate of 4.5% since member A is under age 55.
- Factor at age 55 is 15.8
- The discounting factor from age 55 to age 31 is 1/(1+0.045)^(55-31) = 0.3477
- The pension at age 55 is reduced for 10 years at 3% per year, so the reduction is 30%.

The liability for member A at Jan 1, 2010 is:

2% * 50,000 * 1 * 15.8 * (1-30%) * 0.3477 = $3,846

Member B
The solvency liability for member B at January 1, 2010 is determined by multiplying the actual annual pension by the factor at age 61 using a discount rate of 4.0%:

Liability member B = $42,921 * 14.8 = $635,224

Total solvency liability
The total solvency liability at January 1, 2010 is $3,846 + $635,224 = $639,070

Solvency financial position
The solvency financial position is determined as:

MV of assets at January 1, 2010 – wind-up expense – solvency liability = $720,668 - $5,000 - $639,070 = $76,599

There is a surplus on a going concern basis and on a solvency basis and therefore the special payment schedule is eliminated. The solvency asset adjustment at January 1, 2010 is $0.

Question:

(d) Calculate the minimum required and maximum permitted employer contributions for 2010.

3. Continued

Solution:

To calculate the minimum required and maximum permitted contribution for 2010, first determine the current service cost for 2010.

Current service cost member A
The current service cost for member A is equal to member A's going concern liability at January 1, 2010 since member A has accrued exactly 1 year of service. Therefore member A's liability is $3,846.

Current service cost member B
Member B's current service cost for 2010 is $0 since he is retired.

Total current service cost
The total current service cost for 2010 is $3,846.

Special payments
No special payments are required since there is a surplus on a going concern basis and on a solvency basis.

Excess surplus
Next, determine if there is an excess surplus at January 1, 2010.

The excess surplus is determined as any going concern surplus above the following limit:

Minimum (20% of GC liability, maximum (10% of GC liability, 2 times 2010 current service cost))

The limit is: minimum (20% * $504,861 , maximum (10% * $504,861 , 2 * $2,691)) = $50,492

Therefore, at January 1, 2010, the plan has an excess surplus of:

$215,807 - $50,492 = $165,315.

Since there is an excess surplus at January 1, 2010 and there is sufficient surplus on a solvency basis to support a contribution holiday, the employer is not required nor permitted to contribute.

Minimum and maximum contributions
2010 minimum contribution = maximum contribution = $0.

4. Learning Objective:

Asset liability modeling/Liability driven investments

Source: RD120-07: Asset Liability modeling & asset allocation for pension plans (Wendt)
Liability Driven Investment Strategies
Top 10 Myths about Liability Driven Investing

Commentary from Graders:
In this question, candidates were asked to demonstrate their understanding of LDI strategies and why a plan sponsor may want to use one and also to explain the differences between an asset only space versus an asset-liability space analysis. The CFO's concern was typical and a well-prepared candidate would have been able to address the concerns by showing the advantages of using LDI.

Question:

Your client's CFO returns from a meeting of pension plan sponsors where the topic of Liability Driven Investments (LDI) was discussed. Although interested, he does not believe that it would be an appropriate strategy for NOC's pension plan. The CFO is concerned both about sacrificing potential upside investment returns and timing due to the current low interest rate environment.

Solution:

(a) Explain why the use of an LDI strategy might be appropriate for a plan sponsor.

- Protect downside risk of plan funded status
- Minimize volatility of contribution requirements
- Stabilize pension expense on income statement
- Reduce balance sheet volatility
- Pension plan exists to provide benefits, so assets' performance should be measured against liabilities
- LDI strategies address duration mismatch between liabilities and assets moves
- LDI employs investment strategies that extend duration of portfolio

(b) Compare and contrast efficient frontiers in asset-liability space versus asset-only space

Efficient frontier – graphical presentation of risk/reward trade-off, portfolios with minimum risk for given reward
Equivalently minimum risk for maximum reward

Optimization for investment portfolios depends on definition of risk-reward
Traditional (asset only space, aka Markowitz) efficient frontier uses expected nominal asset return and standard deviation of return as risk
Typically single period frontier

4. Continued

Typically uses quadratic optimizer with linear constraints and utilizes asset only perspective
LDI efficient frontier in asset-liability space optimizes specific asset-liability measures (e.g. funded status versus standard deviation of funded status)
And different measures of risk: downside variance or probability of shortfall (against threshold) or worst most outcome (VAR concept)
Asset-liability space frontier often multi-period
Tool well suited for ALM & LDI modeling as liabilities are incorporated
Picture of sample frontier – either one

(c) Prepare a response to the CFO's concerns.

CFO's first concern is about sacrificing potential upside investment returns, as he may be mistakenly believing that LDI requires an increased allocation to fixed income
LDI strategy to increase duration of bond portion of portfolio without disturbing equity portion, does not give up equity potential upside
Should look at assets/liabilities together: what might be bad for assets may be good for liabilities
Such as: change in inflation if plan in indexed, or
Different duration between assets & liabilities
Other basic LDI strategy utilizes derivatives' overlays,
Such as interest rate swap overlays, or future or forward contracts, or options strategies
Advantages of derivative overlays that existing portfolio structure may remain untouched
Another advantage that very long durations (not available with physical "long" assets) can be achieved
Disadvantages: plan needs sufficient liquidity to fund initial and variations margin requirements, and may introduce other sources or risks: counterparty, liquidity, valuation, tracking, etc.
Another strategy to reallocate some equity into long duration bonds can be accompanied with alpha-producing investment to ensure the same targeted level of expected return
CFO should consider changing his view of "upside" from asset only perspective to asset liability perspective – in context of funded status risk implications
Need to recognize that attempting to time implementation of interest rate hedging program is no different than placing "active bets"

Even if expect interest rates to rise, should recognize the risks taken & talk to their boards
Solution may be to implement LDI strategies on delayed or gradual basis

5. Learning Objective:

Discuss characteristics of Group RRSPs and Group TFSAs. In addition, list and provide options for savings plans that help increase productivity and increase sense of partnership with employees.

Source: 1 Chapter 12, Morneau

Commentary from Graders:
The candidate will be able to describe the structure of different types of non-registered savings plans available in Canada.

Question:

(a) Your client is considering offering a capital accumulation plan for its employees and favors a Group RRSP. However, your client has heard a lot about Tax-Free Savings Accounts (TFSAs) recently and wonders if the company should establish a Group TFSA instead.

Compare and contrast Group RRSPs and Group TFSAs.

(b) Your client has also heard that there are arrangements that could lead to increased productivity and an increased sense of partnership with employees.

Describe these arrangements and how they could help achieve these goals.

Solution:

(a) **1. Comparison of RRSP and TFSA**

1.1. Earnings-related contribution room

1.1.a RRSP: Yes
1.1.b RRSP: Contributions are made by a taxpayer out of earned income
1.1.c TFSA: No

1.2. Annual contribution limit

1.2.a RRSP: Yes
1.2.b RRSP: 18% of earned income up to a dollar limit
1.2.c RRSP: Effective 2010 the dollar limit will be increased based on the average industrial wage
1.2.d TFSA: Yes
1.2.e TFSA: Dollar limit only
1.2.f TFSA: Dollar limit 5000 in 2009 then increased with inflation

1.3. Unused contribution room carried forward

1.3.a RRSP: Yes
1.3.b TFSA: Yes
1.3.c Withdrawals - RRSP: room lost. TFSA: room carried forward

1.4. Are contributions deductible

1.4..a RRSP: Yes
1.4.b TFSA: No

5. Continued

1.5. Are withdrawals taxable
1.5.a RRSP: Yes
1.5.b TFSA: No
1.6. Are investment earnings taxable
1.6.a RRSP: No
1.6.b RRSP: Yes when withdrawn
1.6.c TFSA: No
1.7. Are spousal contributions permitted
1.7..a RRSP: Yes
1.7.b TFSA: Yes
1.7.c TFSA: subject to spouse's contribution room
1.8. Locking-in
1.8.a RRSP: No
1.8.b RRSP: except for funds transferred from a registered pension plan.
1.8.c TFSA: No
1.9. Can assets be used to secure a loan
1.9.a RRSP: No, unless first withdrawn from the RRSP
1.9.b The RRSP is considered a retirement savings vehicle and money in it should be used for retirement
1.9.c TFSA: Yes
1.9.d TFSA is considered a savings vehicle and any money held in it can be used for any reasons
1.10. Use of funds
1.8.a RRSP: purchase annuity
1.8.b RRSP: transfer to RRIF
1.8.c TFSA: Any
1.11. Who benefits most from it
1.11.a Low income earners 18% of income less than $5000
1.11.b TFSA: Individuals more than 71 years old: TFSA is the only tax-assisted savings vehicle available to them
1.11.c TFSA: Individuals who expect to be in a higher tax bracket at retirement than the one they are in now (students, part-time workers)
1.12. Date plan must be closed
1.12.a RRSP: December 31 of the year the individual turns 71
1.12.b TFSA: Death of individual

2. Advantages of group RRSP and TFSA:
2.1: convenient way of saving through payroll deductions
2.2: advantages of greater purchasing power as a group: lower administration and fund management costs, access to a wide variety of investments

5. Continued

3. Disadvantages of group RRSP and TFSA:
3.2. employer contributions immediately vest in the employee
3.3. difficult for employers to use this arrangement as a human resource management tool
3.4. additional cost associated with employer contributions in the form of contributions to government plans (CPP/QPP, EI, provincial health plans, Workers' Compensation) if the employee compensation is lower than the maximum assessable earnings for payroll
3.5. no way to ensure funds will be used for retirement rather than for other personal purposes

4. Advantages of not being subject to pension standards legislation
4.1. no plan text to be registered with a governmental supervisory authority
4.2. more flexibility to vary employer contributions among plan members
4.3. more flexibility in establishing eligibility conditions
4.4. no restriction on beneficiary designation/ no J&S

5. RRSP and TFSA Investments:
5.1. any combination of securities including Canadian and foreign securities

(b) **Cash Profit Sharing**
benefit to employees calculated by reference to employer's profits
instill a sense of partnership between employer and employee
intention to establish a common interest for employees, management and shareholders
simplest and easiest to establish and administer
amounts received as cash and taxed as ordinary income

5. Continued

Employees Profit Sharing Plans
benefit to employees calculated by reference to employer's profits
instill a sense of partnership between employer and employee
intention to establish a common interest for employees, management and shareholders
contributions computed by reference to employer profits or "out of profits"
if reference to profits, minimum 1% of current year's profits
if reference to "out of profits", minimum 1% of employee salary or $100 per member
no limit on amount of deductible employer contributions
can be used as individual profit sharing allocations that exceed DPSP limits

Deferred Profit Sharing Plans
benefit to employees calculated by reference to employer's profits
instill a sense of partnership between employer and employee
intention to establish a common interest for employees, management and shareholders
profit shares allocated to employees are set aside in a fund instead of being paid in cash
employer's contributions calculated by reference to employer profits as a % of profits for the year or "out of profits"
if no profits, no contributions made
If "out of profits", can be defined as undistributed profits for the year or previous years based on a formula (fixed dollar or % of pay)
used as a retirement vehicle
not subject to detailed minimum pension standards legislation
contributions tax deductible/ benefits taxable
no limit on investment in one security so may invest heavily in employer stock
vesting requirements so no losses on quick turnover
lower tax-deductible contribution limits than RPP. 1/2 MPP limit. Less tax deferral
no employee contributions

5. Continued

Stock Savings Plans

Stock Purchase Plans

encourage employees to save and invest in company's stock
can be tailor-made for executives only
maximum placed on number of shares a member may buy or amount of money used to buy shares
maximum often related to employee earnings
if price of share is less than fair market value of shares, employee must pay tax on difference
if employer grants low-interest or interest-free loans less than a prescribed rate to purchase shares, difference taxable

Stock Options Plans

incentive for employees to increase company profitability and thus raise price of shares
employees given option to buy specified amounts of stock at a fixed price on the day option is granted
retain key employees by creating opportunity cost if they were to leave employment (right to exercise optioned shares)
method to compensate employees that is more effective than salary increases
provide employees with satisfaction derived from ownership in the company

Phantom Stock Plans (aka Deferred Share Unit)

bonus or incentive plans where bonus determined by reference to value of company's stock
member account credited with notional shares/dividends and capital appreciation of stock
executive is taxed and company can take tax deduction when benefit is paid
executive does not get capital gains treatment

5. Continued

Restricted Shares
Like a phantom stock plan but notional shares paid after a specified time and not at discretion of executive when shares vest
member granted specific number of shares usually with a two year vesting period
member receives full value of restricted shares after two years even if return in that period was unsatisfactory

Performance Shares
Same as restricted shares but number of shares allocated or vesting of shares depends on achievement of certain corporate or individual objectives
member shares same risks and opportunities as other shareholders
member granted specific number of shares usually with a two year vesting period
member receives full value of restricted shares after two years even if return in that period was unsatisfactory
…

6. Learning Objective:

- Plan design for executives for highly paid
- Identify Employer and Executive's perspectives with respect to deferred compensation

Commentary from Graders:
This is a focused question on comparing executive compensation packages with an emphasis on SERPs. A well prepared candidate would have listed advantages and disadvantages of each approach.

Question:
Your client is looking to hire an executive from a competitor. Describe the advantages and disadvantages of the following potential compensation arrangements from both the executive's and company's perspectives.

Solution:
(i) $500,000 base salary and 50% annual target bonus.

Executive

Advantages:

- Low risk of non-payment
- Amount paid is based on achievement of annual target bonus

Disadvantages:

- Bonus are taxed when received using regular income tax rate

Employer

Advantages:

- Target bonus used to motivate each individual employee's behavior
  - Paid by achievement of annual target bonus
  - Have different target for different individual
- Aligns performance review, financial metrics, etc.

Disadvantages:

- Does not retain employee for more than the year

(ii) $500,000 base salary and 50% annual target bonus, with the option to defer 100% of the bonus.

General:

- Bonus is taxed on receipt
- SDA is a salary deferral program that defers earned income
- Bonus can be deferred for up to 3 years, but taxed even if not paid
- Bonus is taxed in year earned

Executive

Advantages:

6. Continued

- Bonus deferral option are valuable due to potential tax savings if bonus received during retirement or transferred to new employer
- Bonus can defer for up to 3 years

Disadvantages:
- Can be recognized as SDA

Employer

Advantages:
- Executive may view the option to be valuable because can defer tax in year with lower income
- No cash outlay immediately

Disadvantages:
- Does not retain executive beyond the year of bonus payout
- If executive elects not to defer bonus, does not retain executive
- Increase administration cost due to record-keeping
- If recognized as SDA, less valuable incentive to executive

(iii) Reduced base salary, 50% annual target bonus, and a Supplemental Executive Retirement Plan (SERP).

General
- Can fund SERP using RCA
- 50% refundable tax on all contribution and investment earnings

Executive

Advantages:
- Benefits payments received from SERP is taxed upon receipt
- Tax savings if deferred payment until year of lower income
- If SERP is funded, increase benefit security

Disadvantages:
- Reduced salary
- If SERP is unfunded, risk of non-payment due to bankruptcy

Employer

Advantages:
- Can provide unfunded SERP – so no immediate cash outlay
- SERP can supplement/coordinate RPP
- Long term incentive – golden handcuffs and golden handshakes

6. Continued

Disadvantages:

- High administration cost – requires disclosure, valuations, plan doc, etc
- RCA/Funding burden
  - Need trust agreement and trust in place
  - Costly to fund

(iv) $500,000 base salary, reduced annual target bonus, and a stock-based compensation program.

Candidates scoring well on this section described the two main categories of share-based compensation schemes and described the various forms in each category. Advantages and disadvantages were then differentiated depending on whether whole-share or leveraged schemes were considered.

Two categories of share-based compensation

- Leveraged compensation
- Whole share compensation

<u>Leveraged Compensation</u>

Examples of leveraged compensation schemes are:

- Options
  - Right to purchase a share for exercise price
  - Exercise price set at the time the option is granted
  - Short term incentive
- Share appreciation rights (SAR)
  - Entitles holder to a payment as if exercised an option and immediately sold shares
  - Purchased at exercise price and sold at market value

Executive

Advantages:

- Often tax favored
- Potential for very large compensation, if stock performs well

Disadvantages:

- Options do not provide any incentive when significantly underwater
- Could be costly to executive if he cashes in
- May be difficult to understand

Company

Advantages:

- Can be used to retain employee with golden handcuffs
- Can be used to encourage early retirement

6. Continued

Disadvantages:

- Could motivate near-sighted behavior that affects only short-term stock movement
- Options do not provide any incentive when significantly underwater
- May be difficult to communicate plan

Whole Share Compensation

Examples of whole share compensation schemes are:

- Restricted share unit (RSU)
- Performance share unit (PSU)
- Deferred share unit (DSU)
- Share grants

Executive

Advantages:

- Can be used to elect early retirement
- PSU provides transparent reward for meeting goals

Disadvantages:

- No preferential tax status

Company

Advantages:

- Can be used to retain employee with golden handcuffs
- Can be used to encourage early retirement
- Can be used to align with mid to long term objectives

Disadvantages:

- DSUs unsuited to cyclical industries
- DSU may cause executive to resign to realize award
- May be difficult to communicate

7. Learning Objective:

This is a pension mathematics question. The objective of this question is to test the candidate's knowledge and understanding of how an individual and aggregate actuarial cost method are used and applied to determine the total normal cost and accrued actuarial liability for a final salaried defined benefit plan. Candidates are required to demonstrate how to use the normal cost and accrued liability to determine the total Employer contributions as outlined in the question (normal cost and amortization of unfunded accrued liability).

Commentary from Graders:

A strong paper included a complete solution including all formulas and numerical answers for all steps of the question.

Question:

(a) Determine the 2009 employer contribution.

(b) Redetermine the 2009 employer contribution assuming the attained age normal method is adopted effective January 1, 2009.

Solution:

(a) Calculate NC and AL on January 1, 2009.

Member A: $e = 25$ $S_{30} = 20,000$

$x = 30$ $S_{64} = 20,000(1.03)^{34} = 54,638$

$r = 65$ $B(65) = S_{64}(0.015)(40) = 32,783$

Svc now = 5

Svc at Ret = 40

Use EAN, level % of pay since plan is pay related $i = 6\%$, $g = 3\%$

$$NC_5 = B(65)v^{40}\ {}_{40}p_{25}\ddot{a}_{65}^{(12)} / \ddot{a}_{\overline{40}|j} \qquad j = \left(\frac{1+i}{1+g}\right) - 1 \quad j = 2.9\%$$

$$= \frac{(32,783)(1.06)^{-40}(1)(11.8)}{\ddot{a}_{\overline{40}|2.9\%}}$$

$$= 1,559$$

$$NC_{30} = NC_{25}(1+3\%)^5$$

$$= 1,807$$

$$AL_{30} = NC_{30}\ \ddot{s}_{\overline{5}|j}$$

$$= 9,856$$

7. Continued

Member B: $e = 35$ $\quad S_{60} = 80,000$

$x = 60$ $\quad S_{64} = 80,000(1.03)^4$

$r = 65$ $\quad = 90,041$

Svc now = 25 $\quad B(65) = S_{64}(0.015)(30)$

Svc at Ret = 30 $\quad = 40{,}518$

Use EAN – level %

$$NC_{35} = \frac{B(65)v^{30}\ {}_{30}p_{35}\ddot{a}_{65}^{(12)}}{\ddot{a}_{\overline{30}|j}} \qquad j = \frac{(1+i)}{(1+g)} - 1 \text{ as above for (A)}$$

$$= \frac{(40,518)(1.06)^{-30}(1)(11.8)}{\ddot{a}\overline{30}|j}$$

$$= 4,080$$

$$NC_{60} = NC_{35}(1+3\%)^{25}$$

$$= 8,543$$

$$AL_{60} = NC_{60}\ \ddot{s}_{\overline{25}|j}$$

$$= 8,543\ \ddot{s}_{\overline{25}|j}$$

$$= 316,909$$

$$NC_{2009} = 1,807 + 8,543 = 10,350$$

$$AL_{2009} = 9,856 + 316,909$$

$$= 326,765$$

$$F_{2009} = 150,000$$

$$UAL_{2009} = 326,765 - 150,000 = 176,765$$

Over 10 yr factor at 6% $\Rightarrow 7.8$

$\therefore$ annual = 22,657

$\therefore$ Total 2009 cont = NC + amort = 10,350+22,657

= 33,007

(b) AAN original UAL by unit credit method

Member A: $AL_{30} = B_{30}(65) \times v^{35}\ {}_{35}p_{30}\ \ddot{a}_{65}^{(12)}$ $\quad B_{30}(65) = S_{64}(0.015)(5)$

$= (0.4098)(1.06)^{-35}(1)(11.8)$ $\quad = (54,638)(0.015)(5)$

$= 6,291$ $\quad = 4,098$

Member B: $AL_{60} = B_{60}(65)v^5\ {}_5p_0\ddot{o}_{65}^{(12)}$ $\quad B_{60}(65) = S_{64}(0.015)(25)$

$= (33,765)(1.06)^{-5}(1)(11.8)$ $\quad = (90,041)(0.015)(25)$

$= 297,731$ $\quad = 33,765$

7. Continued

$$\therefore \text{ Total } AL_{2009} = 6,291 + 297,731 = 304,022$$

$$F_{09} = 150,000$$

$$UAL_{09} = 154,022$$

over 10 yrs $\Rightarrow 19,742/\text{yr}$

$$AAN: NC_{09} = \frac{\sum PVB_{09} - F_{09} - UAL_{09}}{\sum PVFS / \sum S_{09}}$$

$$A: PVFS = S_{30}\ddot{a}_{\overline{35}|j} \quad \text{j as before}$$

$$= 20,000\ddot{a}_{\overline{35}|j}$$

$$= 447,957$$

$$B: PVFS = S_{60}\ddot{a}_{\overline{5}|j}$$

$$= 80,000\ddot{a}_{\overline{5}|j}$$

$$= 377,990$$

$$PVB_A = B(65)v^{35}\ {}_{35}p_{30}\ddot{a}_{65}^{(12)}$$

$$= (32,783)(1.06)^{-35}(1)(11.8)$$

$$= 50,330$$

$$PVB_B = B(65)v^{5}\ {}_{5}p_{60}\ \ddot{a}_{65}^{(12)}$$

$$= (40,518)(1.06)^{-5}(1)(11.8)$$

$$= 357,273$$

$$PVB_{09} = PVB_A + PVB_B$$

$$= 50,330 + 357,273$$

$$= 407,603$$

$$S_{09} = 20,000 + 80,000$$

$$= 100,000$$

$$\therefore NC_{09} = \frac{407,603 - 150,000 - 154,022}{(447,957 + 377,990)/(100,000)}$$

$$= 12,541$$

$$\therefore \text{Total 2009 cont } = NC + \text{amort}$$

$$= 12,541 + 19,742$$

$$= 32,283$$

8. Learning Objective:

The candidate will understand alternative plan types that occur internationally.

Source: Turner and Wattanbe Chapter 2

Commentary from Graders:
A well prepared candidate will be able to discuss the fundamental questions in structuring pension financing, and how the range of approaches adopted by different countries are important to the overall structure of pension arrangements that must be addressed in designing new pension systems internationally.

Candidates were required to describe the basic financing issues in structuring international retirement plans. Credit was given for any comment on how the structure of the retirement program would be impacted by: the international governmental programs, governmental requirements, who should bear the risk, who should bear the cost, how to fund, and types of institutions or plans that are allowed under the international countries regulatory systems.

Question:

You are the actuary for a global company that would like to establish retirement programs for all of its employees. Describe the fundamental issues in structuring international retirement arrangements.

Solution:

The extent of privatization of retirement income

- Measure of privatization: % of retirement income provided through private sector
- Role varies depending on how generous are SS Benefits

Government requirements voluntary or mandatory

- If voluntary, minimum standards are needed (e.g. minimum participation, minimum funding)

If voluntary, does government encourage or just allow them?

- Does government provide subsidies or preferential tax treatment
- Government may offer nothing and treat as regular savings plan

Who is best able to bear financial risk (Employer vs. Employee)?

- Primary decision should involve whether plan is DB (Employer risk), DC (Employee risk) or hybrid

Does government have mandatory insurance for pension benefits?

- PBGC for example in the US
- Added expanse for employers
- Provides protection if plan terminates without full funding or sponsor becomes bankrupt

8. Continued

- Covers risk of financial malfeasance by sponsor

Should Employee or Employer or both pay for plan?

- In a contributory DB plan, should Employee contribution be mandatory or voluntary?
- In a DC plan with an Employer match, should there be a minimum contribution level or eligibility for the Employer match?

Should benefits be funded in advance?

- Most countries required some form of advance funding.
- Not funding in advance may help you to avoid market risk.

To what extent should pension investment portfolios be regulated?

Why types of organizations are allowed to sponsor plans?

Are individual plans allowed?

- Workers can receive pensions not tied to a particular Employer in some countries.

What types of institutions are allowed to manage pension funds?

- Banks only, Insurance Companies only, both neither, internal management allowed?

9. Learning Objective:

Given a context and the sponsor's objectives, apply the process and principles of converting a DB plan to DC and partially winding-up a DB pension plan.

Commentary from Graders:

This question is a typical scenario in settling past service benefits either through conversion or plan windup. A well prepared candidate would raise the key issues and points in both the conversion and winding up the plan.

Question:

You are the actuary to the national Oil Company (NOC) Full-Time Salaried Pension Plan. NOC wants to eliminate the defined benefit past service liability and is currently looking at two options with respect to active members' past service benefits:

(a) Conversion of past service benefits under the defined benefit plan to some type of defined contribution arrangement; or

(b) Termination/wind-up of the defined benefit provision for the active members.

Compare and contrast the above options.

Solution:

Conversion of the Plan

- DB plan members in Ontario cannot be forced to convert value of accrued benefit into DC accounts
- Conversion cannot reduce benefits already earned to date of conversion

Even if accrued DB benefits are commuted and transferred to DC account, the CV cannot be less than value of benefits immediately before conversion

Ensures that those who have met requirements for ancillaries (such as early retirement enhancements and refund of contributions) do not lose ancillary benefits

- Commuted value of benefits converted to DC cannot be less than value of benefits if member terminated on conversion date

Actuarial basis used in calculating CVs is normally required to be no less than the CIA standard for determining pension CVs

- Conversion does not allow plan members to transfer the commuted value out of the plan.

-In Ontario for members whose pension benefits are based on final average earnings and who elect to convert their DB entitlements, a reasonable projection of salary must be included in conversion value

- ERs may be concerned about cost of converting existing DB to DC
  - may decide to retain existing DB for past service and adopt DC for future service
- ER may decide to grandfather certain employees
  - if new DC formula is not as generous for those close to retirement
- Possible to freeze past service benefits and have DC plan for future service
- DB conversion rarely extends to retirees, beneficiaries, and deferred vested members.

9. Continued

- Ontario requires immediate funding of deficit.
- May need to allocate a portion of Surplus to members.
  Allocation of surplus requires a PA to be reported
- Accounting implications
  – curtailment may occur if doesn't accrue any future DB service
  - Settlement accounting rules may apply if convert past service from DB to DC
- If DC coverage for future service is provided through vehicle other than a RPP and there are no further RPP accruals, may trigger a partial wind-up anyway
- Affected members must be given notice of conversion before effective date of conversion
- Plan text must be amended

-Actuary must prepare report
  - report outlines impact of conversion on funded status and contribution requirements
- May trigger a PAR
- Conversion must be approved by regulators

Wind-up

- Notice of wind-up must be given
  - contains prescribed information
- Once wind-up is declared, only existing pensioner payments and be made from the fund
  - no other benefits can be paid from fund until wind-up is approved or permission is given by regulators
- Plan text must be amended
- actuary must prepare wind-up report
  - report outlines funded status and contribution requirements
- Must be approved by FSCO
- Immediate vesting
- Grow-in
  - members whose age plus continuous service totals 55 at date of wind-up are entitled to "grow-in"
  - entitled to the value of any early retirement subsidies, if provided by the plan
- Assumptions are prescribed to determine the wind up liabilities

-Members can elect to transfer their commuted values /given option statement
  - in accordance with CIA standard
- Members must be given an option statement
- Purchase annuities for members
- If deficit position - will need to fund the deficit
  - immediately
  - with annual payments in advance over five-year period
- No benefits can be paid out until deficit is fully funded or if ER elects to fund over 5 years
  -pro-rata portion of benefits can be paid out
- Annual valuation reports are required if deficiency is not funded

9. Continued

- If plan has Surplus at wind-up date– will need to deal with the surplus issue
    - possible sharing of surplus and distribution of surplus
- All liabilities will be settled
- All plan assets will be distributed
- Accounting impact
    - curtailment rules may apply
    - settlement rules may apply
    - special termination rules may apply

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

Source: Maginn and Tuttle, Ch. 8, Section 6 – Hedge Funds

Commentary from Graders:
This is a question requiring candidates to explain four types of hedge fund investment strategies, and then explain the distinguishing features of hedge fund indices.

In part (a), candidates were required to explain the general strategy and give supporting information showcasing their understanding of the intricacies of each strategy, such as an example, where the arbitrage would come from, etc… Credit was given for points accurately explaining the strategies based on the descriptions in the source material.

In part (b), candidates were required to explain the distinguishing features of hedge fund indices. The source material listed both general features and provided detail on how the indices were constructed. Credit was given for points accurately listing the general features and giving descriptions of how the hedge fund indices could be constructed, as based on the source material.

A well-prepared candidate could accurately explain the four hedge fund investment strategies in general and then provide further detail on each strategy. A poorer candidate tended to give a description based on the words in the strategy name. For part (b), a well-prepared candidate could provide both the general features and then provide further detail on how the different indices could be constructed. The poorer candidates tended to explain the different features of hedge funds or the hedge fund strategies, rather than the hedge fund indices. Also, many candidates who did poorly on section (b) gave a lot of irrelevant information on biases related to hedge funds or certain ratios that measure hedge funds.

Question:
The question had two parts:
(a) Describe the following types of hedge fund investment strategies:
  (i) Equity Market Neutral
  (ii) Convertible Arbitrage
  (iii) Distressed Securities
  (iv) Global Macro

(b) Describe the features which distinguish the different types of hedge fund indices.

Solution:

(a) **Equity Market Neutral Strategy:** Identify overvalued and undervalued equities while simultaneously neutralizing the portfolio's exposure to market risk by

10. Continued

combining both short and long positions. These portfolios tend to be focused either on market, industry, sector, or dollar neutral positions. The strategy is accomplished by holding long and short equity positions with almost equal exposure to the related sector or market factors.

The perceived market opportunity (arbitrage) comes from (1) the portfolio's flexibility to take both long and short positions (without regard to the securities' weights in a benchmark) and (2) the existence of overvalued securities in equity markets ("pockets of inefficiencies").

Convertible Arbitrage Strategy: Managers try to take advantage of anomalies in the prices of corporate convertible securities. The managers would buy or sell these convertible securities and hedge a portion or the entirety of the associated risks. For example, a manager would buy a convertible bond (which can convert to a stock) and then short the associated stock to hedge the equity component of the bond's risk. The risks of this strategy are price changes in the underlying stock and changes in expected volatility of the stock. This strategy makes money if the expected volatility of the underlying asset increases.

Distressed Securities Strategy: The strategy involves investing in both the debt and equity of companies that are in or near bankruptcy. Traditional investors prefer to avoid the risks of companies in danger of default. Also, since distressed debt and equity are relatively illiquid, most hedge funds using this strategy take long positions.

Global Macro Strategy: The strategy attempts to exploit systematic moves in major financial and non-financial markets by trading in currencies, futures, and option contracts. The strategy differs from the traditional hedge fund strategies since it concentrates on major market trends instead of individual security opportunities. Many managers using this strategy also use derivatives (such as futures and options).

(b) There are several general distinguishing features of hedge fund indices:

- If they report a monthly or daily series
- If they are investable or non-investable
- If they list the actual funds used to construct the benchmark

Also, hedge fund indices differ by how they are constructed. The main differences are their selection criteria, their style classification, their weighting scheme, their rebalancing scheme, and their investability.

For selection criteria, indices will differ based on their decision rules to determine which hedge funds are included in the index.

10. Continued

For style classification, different indices have various approaches to determine how each hedge fund is assigned to a style-specific index and to determine if that fund matches the style classification methodology or should be excluded from that style-specific index.

For the weighting scheme, indices have different schemes to determine the weighting of an individual fund's return to the entire index. For the rebalancing scheme, indices have different rebalancing rules to determine when the assets are reallocated among the different funds in an equally weighted index.

Lastly, indices may be directly or only indirectly investable.

11. Learning Objective:

1. Given the context of the NOC Salaried Pension Plan, the methodologies and components of setting a discount rate, a salary rate and mortality assumption for a going concern valuation
2. Given the context of the NOC Salaried Pension Plan, the consideration of implementing a disability retirement assumption

Source:
Selection of Actuarial Assumptions RD-112-07;
ASOP 27 and 35;
CIA Educational Note on Selection of Mortality Assumptions for Pension Plans

Commentary from Graders:
This question is to test the candidate's methodologies of setting assumptions for going concern valuation purposes. In part (a), candidates were required to describe the 2 methods of setting a going concern discount rate and then discuss the components of setting a salary increase assumption. In part (b), candidates were required to discuss the considerations for setting a mortality assumption and the ways to reflect mortality improvements as well as provide further comments and observations based on NOC Salaried plan's situation. In part (c), credits were given if the candidates specifically answer with respect to "disability retirement", not "disability incidence" or "disability mortality assumptions."

Question:
(a) Describe how you would establish the following assumptions:

Solution:
Discount rate
Reflects anticipated returns based on plan's current and future asset mix according to the investment policy
Building block method

- determine weighted average of expected returns for each asset class
- Expected return for each assets class composed of inflation, plus real return

Cash flow method

- Determine IRoR for hypothetical portfolio (in and prin match exp cash flows)
- Then you add a risk adjustment factor reflecting the asset mix of the portfolio

Two methods create a gross RoR which will have to be reduced for expenses. For NOC Salaried Plan, the expense is payable outside of the plan

Salary Scale
Usually developed through building block approach
Consists of the following

- Inflation component
- Productivity component
  - consists of growth for economy
  - plus industry/employer/regional adjustment

11. Continued

- Aging or merit
  - younger employees tend to receive larger % increase
  - could look at history for this component

- NOC assumptions show only 0.5% for productivity and age increases
- Although salary gains recently, should not assume in perpetuity. Salary scale of older members may be overstated, therefore justifying using age related increase.

Question:

(b) Describe issues you would consider when establishing a mortality assumption

Solution:

Salaried Plan has experienced mortality losses over past few years
Industry, type of employee (e.g. White collar / Blue Collar)
Plan is not large enough to develop own experience
Consider current levels as well as future improvement

- could use a static table with projections to certain date
- or generational mortality

Question:

(c) There have been significant increases in the number of disabled pensioners in the plan. Describe the considerations in introducing a disability retirement assumption.

Solution:

- experience is too small for study

Depends on disability provisions within plan

- From pension plan perspective, incentive to stay on as benefits continue to accrue

Depends on NOCs disability plan

- If disability benefit generous then incentive to stay "disabled"
- Should consider definition of disability (any occupation versus own occupation)

- Drug and health benefits may influence when a disabled member retires

12. Learning Objective:

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

(a) Describe the structure of the following plans: Fixed dollars and pay-related defined benefit plans, hybrid plan design, defined contribution plan

(b) Given a plan type, explain the relevance and range of plan features including the following: plan eligibility requirements, benefit eligibility requirements, benefit / contribution formula, payment options, ancillary benefits, benefit subsidies

Discuss common multi-employer plan benefits and designs and explain how the different plan designs can help mitigate future financial difficulty.

Explain how multi-employer pension plan designs and features can help mitigate future financial difficulty.

Source:

R-D100-07 Multi-Employer Plans
R-D607-07 Pension Surplus and Deficit Funding: Funding of Multi-Employer Plans

Commentary from Graders:

A well-prepared candidate would have:

- described design features of multi-employer plans
- addressed issues of cost containment in describing multi-employer plan design features
- discussed alternate plan designs (defined contribution, hybrid/cash balance) in addition to traditional multi-employer plan designs
- considered how membership demographics affect plan design features from a cost perspective

Question:

Explain how multiemployer pension plan designs and features can help mitigate future financial difficulty.

Solution:

Multi-employer plan

- basic idea
  - several employers and union get together to negotiate contribution rate
  - actuary comes in and designs a benefit that can be sustained by contribution rate
  - as benefit levels and funding status increase, contribution rates increase
- basic formula
  - most common formula is flat dollar amount per year of service
  - flat dollar amount increases based on funded status of the plan / union negotiations
  - less common formula is percentage of pay per year of service
- design considerations

12. Continued

- early retirement (ER) benefits
  - most offer ER subsidies
  - can be fully subsidized, partially subsidized or actuarially reduced
  - most plans allow different sets of early retirement factors depending on age and service
- late retirement
  - most plans defer receipt of benefit while working past normal retirement age
  - with worker shortage that is being reconsidered
- death benefits
  - most plans offer better-than-minimum qualified joint and survivor annuity
- disability benefits
  - most plans require eligibility (55 & 10, for instance)
  - must have proof of disability from social security
  - can commence benefit unreduced in most places
- forms of benefit
  - lump sums are generally not allowed
    - employer wants the employee to have a benefit at retirement so lump sums are sometimes taken and spent before retirement
  - some plans allow for a pop-up benefit
    - when joint annuitant dies, the participant's benefit increases
  - most allow for payment of a 13th cheque during the year
- year of credited service
  - a year of service is credited when an employee worked between 800 and 1,800 hours in a year
  - extra hours worked in one year can be rolled over to the next year because of hours volatility
- vesting
  - same as single employer plans
    - 5-year cliff or 7-year graded vesting are statutory minimums
    - cliff vesting most common
- other benefits
  - most plans allow for COLAs

- if plan is in deficit, employer needs to put in money in addition to employer contribution rate
  - or can increase contribution rate but not benefits
- other ways to mitigate financial difficulty
  - strict eligibility
  - don't give ER subsidies that are too generous
  - no lump sum option (delays needing benefit payouts right now)
  - use flat dollar benefit for better predictability

13. Learning Objective:

The candidate will be able to evaluate the actuarial considerations in plan options and administrations, including:

- Assess the financial impact from options offered, including early retirement and optional form factors.
- Assess the impact of applicable regulations, including commuted value standards and Income Tax Act limits.

Source:

CIA Consolidated Standards of Practice – Practice-Specific Standards for Pension Plans 3000 - 3860

Commentary from Graders:

A well prepared candidate should be able to:

- Determine the pension payable at early retirement in accordance with the plan's terms;
- Determine the applicable select and ultimate interest rates and commuted value in accordance with the CIA's Commuted Value Standards
- Apply actuarial equivalence factors to determine the optional form pension under a joint and survivor basics; and
- Apply the appropriate maximum pension limits and maximum transfer value factors in accordance with the Income Tax Act.

Question:

Calculate and describe the benefits payable under the normal form and each optional form of payment.

Solution:

Under normal form:

Service = 25
retirement age = 58
ERF = 1 – 8.04 (62 – 58) = 0.84

- Annual benefit = Monthly benefit × 12 × service × ERF

$$50 \times 12 \times 25 \times 0.84$$
$$= 12{,}600$$

So under the normal form of payment, the member would receive an annual pension of $12,600 payable monthly for their lifetime.

Determine if pension is under ITA limit

13. Continued

ITA ERF = 0.25%/month for each year member would have attained earliest of age 60, 30 years of service and 80 points
= 0 (since member has 83 points)

2009 ITA limit = DB limit × credited service × (1.0 – ITA ERF)
= 2,444.44 × 25 × (1.0 – ITA ERF)
= 61,111.11

Therefore, the annual pension not affected by ITA limit

Joint & Survivor 60% optional form calculation:

Need to determine appropriate discount rate for actuarial equivalence calculation. Calculate interest rates for commuted value based on CANSIM rates at end of May 2009.

From data:

$i_7 = 2.86\%$

$i_L = 4.25\%$

$r_L = 2.35\%$

First calculate non-indexed select and ultimate rates (round to 10 bps)

$i_{1-10} = i_7 + 0.9\% = 3.76\%$ rounded to 3.80%

$i_{10+} = i_L + 0.5(i_L - i_7) + 0.9\% = 5.815\%$ rounded to 5.80%

Then calculate fully indexed select and ultimate rates:

$r_{1-10} = r_7 + 0.9\%$ $\qquad r_7 = r_L \times i_7 / i_L = 1.58889\%$

= 2.4889% rounded to 2.50%

$r_{10+} = r_L + 0.5(r_L - r_7) + 0.9$

= 3.6305% rounded to 3.60%

Now calculate implied inflation:

$$1.24013\% \inf_{1-10} = \frac{i + i_{\text{sel}}}{I + r_{\text{sel}}} - 1 = \frac{1.0576}{1.02489} - 1 = 1.24013\%$$

$$\inf_{10+} = \frac{I + i_{\text{ult}}}{i + r_{\text{ult}}} - 1 = \frac{1.05815}{1.036305} - 1 = 2.10797\%$$

13. Continued

actual indexation is 50% of CPI

- select indexation rate = 0.62007%

ultimate indexation rate = 1.05399%
finally the interest rates to use for actuarial equivalence are

$$I + g_{1-10} = \frac{I + i_{1-10}}{I + ind_{sel}} = \frac{1.0376}{1.0062007} = 1.03121$$

- $g_{1-10} = 3.1\%$ (rounded to 10 bps)

$$I + g_{10+} = \frac{I + i_{10+}}{I + ind_{10+}} = \frac{1.05815}{1.0105399} = 1.0471135$$

- $g_{10+} = 4.7\%$

Therefore, cv rates are 3.1% for first 10 years, 4.7% for years thereafter

Now need to convert life only pension to J&S60% pension using these rates:

$\ddot{a}_{58}^{(12)} = 15.9$ $\ddot{a}_{55}^{(12)} = 17.7$ $\ddot{a}_{58:55}^{(12)} = 14.6$

Equivalence Equation:
Normal form pension $X\,\ddot{a}_{58}^{(12)}$ J&S60 pension

$$12,600 \times 15.9 = X(15.9 + 0.6(17.7 - 14.6))$$

- X = 11,280

∴ Under a J&S 60% optional form selection, the member would receive an amount of $11,280 annually payable monthly for their lifetime. After the member's death, the member's spouse would receive $6,768.24 (60%) annually payable monthly for their lifetime.

Lump sum payment of commuted value
The total commuted value of the pensions is:
12,600 × 15.9 = 200,340 (using factory from previous work)

Accrued pension is 50 × 12 × 25 = 15,000
MTV factor at age 58 is 11.0

- maximum transfer value = unreduced pension X MTV @ age 58
  15,000 × 11.0 = $165,000

13. Continued

under a lump sum option, the member would receive $165,000 as locked-in funds and the remaining $35,350 as non-locked in funds which may be taken as cash or transferred to a non-locked-in RRSP.