DP-RC Complete Illustrative Solutions
Fall 2011

1.

Learning Objectives:

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

11. The candidate will be able to apply standards of practice and the guides to professional conduct.

Learning Outcomes:

(7a) Assess data quality.

(7b) Identify data needed.

(11a) Explain and apply the Guides to Professional Conduct.

(11c) Demonstrate knowledge of requirements regarding the actuary's responsibilities to the participants, plan sponsors, etc.

(11e) Recognize situations and actions that violate or compromise Standards or the Guides to Professional Conduct.

(11f) Recommend a course of action to repair a violation of the Standards or the Guides to Professional Conduct.

Sources:

ASOP 23

R-D 613-11: CIA, Standards of Practice–General Standards 1000–1800

CIA Rules of Professional Conduct, AAA Code of Professional Conduct, SOA Guides to Professional Conduct

R-D 614-11: CIA, Standards of Practice, Practice-Specific Standards for Pension Plans Sec. 3000–3500

Commentary on Question:

In this question, candidates were asked to demonstrate how they would handle data issues in accordance with the professional standards and code of conduct, which an actuary must consider when assuming work from a prior actuary.

1. Continued

Well-prepared candidates should be able to demonstrate not only their understanding of the professional requirements or guidelines on data review/validation, but also how to apply them in the real-life situation described in the question.

In part (a), we looked for the appropriate actions or steps to review the data provided given that it had already been used in an actuarial valuation and the necessary checks that should be conducted when using the data provided by another actuary.

In part (b), the question stated that data issues have already been uncovered. The candidates were expected to focus on describing how to deal with the data issues in a professional manner in order to complete the valuation, including what needs to be disclosed, documented, and discussed with appropriate parties.

Solution:

Your client has asked you to conduct a valuation of a plan using the same membership data that was used in a valuation previously completed by another actuarial firm. The prior valuation and your valuation both have the same calculation date.

(a) Describe the professional guidelines with respect to conducting membership data reviews and validations that should be performed prior to using this data.

When reviewing the data, the actuary should (per Code of Professional Conduct)

- Satisfy the applicable standards of practice
- Note: Marks will also be given if candidate mentions that the actuary should:
  - Act honestly, with integrity and competence, and perform professional actuarial services with skill and care
  - Take reasonable steps to ensure professional actuarial services are not used to mislead others

Reliance on Other's Work

- The actuary may rely on data from the other firm, subject to appropriate data review/validation.

Nature and Limitations of Data

- Identify data elements needed for valuation in hand.
- Consider if the data provided require any enhancements (i.e. if any additional data is needed) for the valuation. Note: Marks will also be granted if the candidate mentions that the actuary should keep in mind that data requirements vary depending on the nature of the valuation.)
- If additional/alternative data are needed, consider the associated cost/time/feasibility/resources.

1. Continued

- Consider if it is necessary to apply any judgmental adjustments, approximations or assumptions to the data.

Data Sufficiency and Reliability

- Consider if the data are sufficient and reliable for the valuation.
- Consider if the data are appropriate for the valuation.
- Consider if the data are reasonable and comprehensive for the valuation.
- Consider if there are any known, material limitations in the data provided.

Data Review and Control

- Review consistency between current data and the data used in prior analysis or period. (Note: Marks will also be granted if the candidate suggests performing an experience gain/loss analysis.)
- Check data for internal AND external consistency. (Note: Marks will also be granted if the candidate lists the relevant tests for internal and external consistency)
- Identify any questionable or unreasonable data values.
- Do some random spot checks (e.g. spot check a few records from each membership category).
- Note: Marks will be given if the candidate lists some real-life tests, such as doing a membership reconciliation, checking benefit payments versus financial statements etc.

(b) Your review has uncovered a number of membership data issues. In order to complete your valuation, describe the actions and steps you need to undertake to resolve these issues and the applicable professional standards.

Data Adjustments or Approximations

- To address data issues, consider if necessary to apply judgmental adjustments, approximations or assumptions to data.
- If the data issues could have a material impact on the valuation, consider further actions to improve data quality. (Note: Marks will be granted if the candidate suggests some ways to improve data quality.)
- If the ideal data cannot be obtained at reasonable cost within available time, consider what (if any) alternative data are sufficient and reliable.

Data Disclosure Requirements

- The actuary should disclose:
  - Any material limitations in the data and their implications
  - The source of data
  - That the actuary reviewed the data
  - The extent of reliance on data supplied by others

1. Continued

- Any material judgmental adjustments or assumptions applied to the data
- Any limitations on the use of the valuation report (or results) due to uncertainties about data quality
- Any unresolved data issues that could have a material effect on the valuation
- Existence of results that are highly uncertain or may have material bias because of the data issues, and quantify the impact (if possible)

- Any conflicts that arose from complying with the applicable legislation or binding authority

- If actuary uses but does not take responsibility of data, he/she should:
  - Report so
  - Report with reservation on data
  - Report results of examination/review on data provided
- The actuary who takes responsibility of data should classify data as one of:
  - Sufficient and reliable - report an opinion without reservation on data
  - Defective but not so as to negate the usefulness of valuation - report a usual opinion with reservation which describes data issues, work done and assumptions
  - So defective as to preclude a useful valuation - reports so or makes no report

Miscellaneous

- Documentation:
  - Document the data evaluation process.
  - Describe any material defects in the data.
  - Describe any judgemental adjustments or modifications made (to address data issues) and the rationale.
- Assess whether data issues could have a material impact on the prior valuation prepared by the other firm and if so, discuss with the other actuary.
- Note: Marks will also be granted if the candidate:
  - Mentions that the prior actuary is required to cooperate, per Code of Conduct.
  - Alludes to the Code of Conduct regarding communication with the prior actuary.

2. 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.

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

11. The candidate will be able to apply standards of practice and the guides to professional conduct.

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

(1b) Describe the process and apply the principles of conversions from one plan type to another.

(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

(7a) Assess data quality.

(7b) Identify data needed.

(11a) Explain and apply the Guides to Professional Conduct.

(11c) Demonstrate knowledge of requirements regarding the actuary's responsibilities to the participants, plan sponsors, etc.

(11e) Recognize situations and actions that violate or compromise Standards or the Guides to Professional Conduct.

2. Continued

(11f) Recommend a course of action to repair a violation of the Standards or the Guides to Professional Conduct.

Sources:
Allen (Chapter 21)

Morneau Sobeco 14th Edition (Chapters 1, 2, 12)

R-D101-07: Converting Pension Plans from a Defined Benefit to a Defined Contribution Design - Issues to Consider in Canada

Commentary on Question:
In this question, candidates were asked to demonstrate an understanding of the process and implications of an organization shifting a retirement program from a DB plan to a DC plan, including various DC alternatives and transition approaches. Key corporate objectives were provided to help candidates focus their responses accordingly. Candidates should understand how employees at all levels are impacted by changes in retirement programs. A well prepared candidate would have communicated the impact on the employer and employee, the competitiveness relative to competitors provided, and provided detailed analysis of the design alternatives and transition approaches to enable NOC to make an informed decision in light of their key objectives. They would also be prepared to address other considerations that may impact the decision making process.

Solution:
In order to become more competitive in the future, NOC is considering freezing the Salaried Full-Time Pension Plan and providing future retirement benefits through a defined contribution plan.

(a) Discuss the implications of the plan freeze for:
  (i) NOC; and
  (ii) the salaried employees.

  <u>Implications to NOC</u>
  Freezing the DB plan will result in NOC losing the ability to manage their workforce through the use of early retirement windows, and the plan freeze may also impact their ability to retain longer service employees. The plan freeze may result in lower future costs, and NOC should take the opportunity to minimize the ongoing cost volatility since the DB plan is no longer the primary retirement benefit. Implementing a plan freeze and moving to a DC approach is more in line with competitors.

2. Continued

Implications to NOC's salaried employees

All salaried employees will experience a reduction in their projected benefits; however late career employees will be significantly impacted since higher accruals occur the closer employees are to retirement. There will also be a loss of pre-retirement inflation protection. Other considerations include the loss of guaranteed death benefits for future benefit accruals, less protection in case of disability, and no access to DB benefits until termination or retirement.

(b) Compare and contrast the following two design alternatives in light of NOC's objectives:

(i) Extend the Part-Time DC Pension Plan to the salaried employees.

(ii) Implement a DC pension plan

Encourages greater cost sharing

Both design alternatives require employees to share in the cost of retirement, each requiring a 6% employee contribution to achieve the fully company match. Employees would now also bear the investment risk associated with their retirement benefits, further emphasizing that saving for retirement is a joint responsibility.

Provide Competitive Retirement Benefits

Offering a DC plan is in line with the competitors listed, and matching is a key feature. DC plans tend to be attractive to a younger, more mobile workforce. Both alternatives listed are at or above the median of the competitor benefits. Option 1 provides the same level of benefits to all employees, and provides a maximum employer contribution of 7.5%. This option is above the median of the value provided by the competitors listed (Company 1 -7%, Company 2 - 6%, and Company 3 - varies; up to 8%).

Option 2 is a service-base contribution approach providing higher benefits to those with longer service. This may be more difficult to communicate to employees, and does provide different benefit structures for full-time versus part-time employees. Option 2 provides up to 8.0% of employer contributions for employees with at least 10 years of service and deferring enough to maximize the employer match. Employees with less than 5 years of service will only receive a 3% employer contribution. This option is better than the competition for employees with 10 years of service and worse than the competition for employees with less than 5 years of service.

2. Continued

Minimize impact on late career employees
Without a transition approach, late career employees may be negatively impacted; NOC could provide some level of grandfathering. Moving to a DC approach will no longer provide pre-retirement inflation protection on the DB benefits. Option 2 may help offset some of the negative impact of the change for longer service employees since they receive higher benefits under that structure. However, retention of late career employees may be difficult.

(c) Critique the following two transition approaches.

(i) Grandfather all members who are retirement eligible at transition.

This approach provides pre-retirement inflation protection for retirement eligible employees and will protect the benefits for the oldest and longest service employees. An employee age 55 with 10 years of service currently has an accrued benefit of 20% of their final average pay, and the transition would allow 40% of their final average pay at normal retirement age; this is much more generous than the 7-year DC transition approach with 2% additional employer contributions. However, the cost savings of moving to a DC approach may be offset by the grandfathering costs. NOC may also have issues retaining employees that are not part of the grandfathered group.

(ii) Members age 45 and over at transition receive an additional 2% contribution for up to 7 years.

The DC approach for 7-years could help bridge some of the shortfall for those closest to retirement. The 2% per year for 7-years partially offsets what would have been accrued under the FAP formula, and would likely have lower cost volatility versus the DB transition approach. This approach does give up the flexibility of using the retirement program as a retention tool and could have adverse accounting implications. There may also be potential discrimination issues, as well as employee issues as some employees may not be happy that they missed the cutoff to receive the additional DC allocation. The transition is also a temporary period. There may be issues with retention at the end of the transition period.

3. Learning Objectives:

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

Learning Outcomes:

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

(6i) Select demographic and economic assumptions appropriate for a projection valuation designed for a given goal.

Sources:

R-D112-10: 2009 Selection of Actuarial Assumptions, Consultant Resource Manual

7/2001 Pension Forum: Dynamic Pension Plan Valuation

R-D117-07: Pension Projections

R-D613-11: CIA CSOP excerpt 1000-1800

Commentary on Question:

In this question, the candidate is asked to outline the considerations that should be taken into account when selecting certain actuarial assumptions with respect to point-in-time and projection valuations.

The intent of this question is to compare and contrast the similarities and differences in setting assumptions for the two valuations in light of three specific business events. A well-prepared candidate will not only point out the differences in considerations between setting point-in-time and projection valuation assumptions in each of these situations for the four assumptions in question, but will also outline the similarities in detail. A successful candidate will reflect the impact of the three significant events occurring at the company into their assumption setting considerations.

Many candidates did not preface their discussion on assumptions with the requirements under professional requirements or explain the differences between point-in-time and projection valuations. In addition, many candidates did not provide sufficient written comments on each of the assumptions.

Solution:

Compare and contrast the considerations in setting the following assumptions for the NOC Full-Time Salaried Pension Plan for a point-in-time closed group valuation versus a stochastic 10-year open group projection valuation.

(i) Salary Increases
(ii) Termination Scale
(iii) Retirement Scale
(iv) New Entrant Profile

3. Continued

Valuation Type: General
- Need to follow ASOPs 27 and 35
- Economic Assumptions should be consistent with each other
- Demographic assumptions should be expected to appropriately model contingencies
- Not be expected to produce significant cumulative gains or losses over the period for which the assumption applies
- Should not confuse short-term expectations with long-term trends

Valuation Type: Point-in-time
- Valuation based on population at a fixed date
- Assumptions used to spread cost over future years and are based on long-term expectations

Valuation Type: 10-Year Stochastic Projection
- Need to determine assumptions for bringing population forward
- Projections reflect population changes and investment return of the plan
- Projection assumptions are referred to as "real-world" assumptions and are based on short-term expectations
- Using a single assumption set or average rates could distort results (i.e. Age 62 retirement, Salary scale of 3%)
- Valuation results can be sensitive to minor changes in key assumptions
- A probability distribution is assigned to many of the assumptions

(i) <u>Salary Increases</u>

Valuation Type: General
- Salary increase is a function of:
  - Inflation
  - Real Wage Growth
- Younger employees tend to get larger percentage pay increases
- Single rate assumption can skew results (likely to overstate liabilities)
- Age/merit scale can be constructed using current/historical data
- Merit is independent from inflation and should be a function of age for both valuations and projections

Valuation Type: Point-in-time
- May consider moving to a select/ultimate merit rate to factor in short-term wage freeze
- Valuation assumptions are long-term, so it is not necessary to change if it is expected that the current rate will not produce significant gains or losses over the measurement period
- Should consider revising the single rate assumption as the demographics of the plan will change (no new hires until 2017, ER window until 2015)

3. Continued

- Since using a single rate assumption, may wish to move to age/merit scale to get better results

Valuation Type: 10-Year Stochastic Projection

- Inflation and productivity should reflect economic conditions and vary year-by-year
- Projection salary scale only used to bring population forward from one year to the next
- Salary increase assumption is a key economic assumption in a projection
- Since projection assumptions are "real-world", then salary increase assumption should be 0% through 2015 and based on employer expectations and expected economic conditions afterward
- Since using a single rate assumption, may wish to move to age/merit scale to get better results

(ii) <u>Termination Scale</u>

Valuation Type: General

- Turnover rates usually vary by the following:
  - Age
  - Age and Service
  - Can use select/ultimate table if the plan has a large population
  - Gender
- Unlike other decrements (e.g. mortality & disability), large plans will have enough experience to develop rates
- Can use a published table if there isn't sufficient data
- Rates should reflect future expectations, not just past experience

Valuation Type: Point-in-time

- Valuation turnover assumption should be based on long-term expectations
- May consider moving to a select/ultimate rate to factor in early retirement window
  - Members can retire as early as age 50, so no withdrawal rates for those who qualify
  - Members may voluntarily terminate more frequently due to the pay freeze
- Members unlikely to voluntarily terminate immediately prior to being eligible for ER window
- Valuation assumptions are long-term, so it is not necessary to change if it is expected that the current rate will not produce significant gains or losses over the measurement period
- However, not changing the rates may result in understated liabilities

3. Continued

Valuation Type: 10-Year Stochastic Projection

- Projection assumptions should reflect factors like:
  - Economic conditions (slow economy)
  - Workforce reductions
  - Projection assumption should have select/ultimate rates if reflecting factors above
- Termination scale should be adjusted (select rates introduced) so that there are no withdrawal rates for members who are 50 years old and have 20 years of service through 2015
- Ultimate rate could be same as valuation assumption

(iii) <u>Retirement Scale</u>

Valuation Type: General

- Past experience or estimate of future retirement patterns can be used to develop assumption
- Should consider the following when setting the assumption:
  - Plan design factors that influence retirement patterns
  - Higher rates when a member qualifies for subsidized benefits
  - Lower rates immediately before becoming eligible for subsidies
  - Availability of government benefits (CPP/OAS)
  - Eligibility for other post-employment benefits (retiree medical, dental)
- Need to also consider the following:
  - Early retirement windows
  - Economic conditions
  - Financial position of the employer

Valuation Type: Point-in-time

- Valuation assumption may use a single rate assumption however the single point assumption of 62 does not reflect the early retirement subsidies of the ER window
- Should consider introducing a select/ultimate rates to capture members leaving earlier than age 62 (due to ER window and regular provisions)
- Better to use an assumption set as opposed to a single rate
- If age/service based, should consider that members will be less likely to retire if they are near eligibility for ER window
- Valuation assumptions are long-term, so it is not necessary to change if it is expected that the current rate will not produce significant gains or losses over the measurement period

3. Continued

Valuation Type: 10-Year Stochastic Projection

- Projection assumption should be based on expected rates
- Assumption affects projection of liabilities and cash flows
- Events such as early retirement windows should be considered
- Single point assumption of 62 does not reflect the early retirement subsidies of the ER window
- Should consider introducing select/ultimate rates to capture members leaving earlier than age 62 (due to ER window and regular provisions)
- Better to use an assumption set as opposed to a single rate
- If age/service based, should consider that members will be less likely to retire if they are near eligibility for ER window
- Using an assumption set will produce better expected cash flows

(iv) <u>New Entrant Profile</u>

Valuation Type: Point-in-time

- Not needed for point-in-time valuations

Valuation Type: 10-Year Stochastic Projection

- Need to make an assumption for the following new entrant characteristics:
  - Sex
  - Age at plan entry
  - Entry salary rate
  - Number of new entrants
- Plan sponsor is the best source of information
- Reflect current hiring practices, economic conditions, and business environment
- Should adjust new entrant characteristics to reflect hiring freeze until 2017
- Assume no new entrants for that period
- May want to increase new entrants for the period that follows as the employer may begin hiring at a faster pace
- Should discuss with the employer regarding their expectations after the freeze is over

4. 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:

Anderson

Commentary on Question:

In this question, candidates were asked to demonstrate their understanding of the attained age actuarial cost method and their ability to use this method to calculate the actuarial liability, normal cost and to reconcile the change in normal cost from one year to another.

A well prepared candidate would have been able to use the attained age method to calculate the requested information. Most candidates completed parts(a) and (b) correctly but very few understood how to reconcile the normal cost *rate* under part (c) from one year to the next given the retirement and investment losses under AAN.

Solution:

You are the consulting actuary for an employer who sets up a new non-contributory defined benefit pension plan on January 1, 2011 that will recognize employees' past service.

(a) Determine the accrued liability and normal cost as at January 1, 2011.

Under Attained age normal, unfunded actuarial liability ("UAL) is equal to the actuarial liability ("AL") under Unit Credit

x = current age

y = retirement age

$AL = \Sigma B(x)\, \ddot{a}_y(12)[1\text{-reduction}]\, v^{(y-x)}$

u_t = Normal Cost rate per active member

$$= \frac{\Sigma PVFB_t - UAL_t - F_t}{\Sigma PVFY_t}$$

Member A x =54, y=62

$AL_{11} = B(54)\, \ddot{a}_{62}(12)\, [1 - 0.03(3)]\, v^{62-54}$

$= (35)(12)(24)(12)(0.91)\, 1.055^{-8}$

= 71,723.83

4. Continued

$PVFB_{11} = AL_{11}$ x svc at retirement / accrued svc
$PVFB_{11} = 71{,}723.83 \times 32/24$
$= 95{,}631.78$
$PVFY_{11} = \ddot{a}_{8|5.5\%} = 6.6830$ (since no pre-ret decrements)

Member B x =40, y=62

$AL_{11} = B(40)\, \ddot{a}_{62}(12)\, [1 - 0.03(3)]\, v^{62-40}$
$= (35)(12)(5)(12)(0.91)\, 1.055^{-22}$
$= 7{,}061.35$

$PVFB_{11} = AL_{11}$ x svc at retirement / accrued svc
$PVFB_{11} = 7{,}061.35 \times 27/5$
$= 38{,}131.29$

$PVFY_{11} = \ddot{a}_{22|5.5\%} = 13.2752$

$$u_{11} = \frac{(95{,}631.78 + 38{,}131.29 - 71{,}723.83 - 7{,}061.35)}{6.6830 + 13.2752}$$
$= 2{,}754.65$

$TNC_{11} = u_{11} \times 2 = 5{,}509.30$

(b) On December 31, 2011, Member A retires. Calculate the accrued liability and normal cost as at January 1, 2012.

$UAL_1 = (UAL_0 + NC_0)\,(1+i) - iC_0$
$= (78{,}785.18+5{,}509.30)*1.055 - 15{,}000*1.055$
$= 73{,}106$

$F_1 = 12{,}000$

$AL_1 = 73{,}106 + 12{,}000$
$= 85{,}106$

$PVFB_{12}A = B(55)\, \ddot{a}_{55}(12)\, [1 - 0.03(10)]$
$= (35)(12)(25)(14)(0.70)$
$= 102{,}900$

$PVFB_{12}B = PVFB_{11}B * (1+i)$
$PVFB_{12}B = 38{,}131.29 * 1.055$
$= 40{,}228.52$

$PVFY_{12}B = \ddot{a}_{21|5.5\%} = 12.9504$

4. Continued

$$u09 = \frac{\Sigma PVFB_{12} - UAL_{12} - F_{12}}{\Sigma PVFY_{12}}$$

$$= \frac{(102{,}900 + 40{,}228.52 - 85{,}106)}{12.9504}$$

$= 4{,}480$

$= TNC_{12}$ (1 Active Member)

(c) Reconcile the change in the normal cost by source.

Change in Normal Cost

$U_{12} = 4{,}480$

$U_{11} = 2{,}755$

$\Delta = 1{,}725$

$PVFY_{12}B = 12.9504$ (from part b)

Investment Gain = actual return - expected return

$= (3{,}000) - 15{,}000\ (0.055)$

$= (3{,}825)$

Change in NC due to Investment Gain

$= 3{,}825 / 12.9504$

$= 295 \rightarrow$ Increase in normal cost

The only other source of change in the normal cost is Member A's retirement.
Impact of Member A's retirement on the normal cost is therefore:
Total increase – increase due to investment loss
$= 1{,}725 - 295 = 1{,}430 \rightarrow$ Increase in normal cost

5. 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:

(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

(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.

(5c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding and asset valuation methods.

Sources:

R-D612-10: Ontario Pension Benefits Act RRO 1990, Reg 909

R-D600-10: Ontario Pension Benefits Act RRO1990, Reg 909 - freeze and study note

Towers Watson, Canadian Pensions and Retirement Income Planning , 4th Edition, 2010, Chapters 15, 18

Commentary on Question:

In this question, candidates were asked to demonstrate their ability to calculate contribution requirements (minimum and maximum) with a funding policy in place. A well prepared candidate would demonstrate a good understanding of the calculation of contribution requirements to ensure compliance with Ontario Pension Benefits Act, the Income Tax Act and the funding policy.

Most candidates performed well on this question. A few candidates forgot to eliminate the going concern schedule in year two and also did not apply the terms of the funding policy correctly. With respect to part (d) of the question, many candidates did not determine part (d) correctly or completely omitted this part of the question – this may have been due to time constraints.

Solution:

You are the actuary for an Ontario registered defined benefit pension plan in a large deficit position.

(a) Calculate the minimum and maximum statutory contributions for 2011.

5. Continued

Going concern deficit
= 600,000 - 750,000
= 150,000

Solvency deficit
= 600,000-30,000-900,000
= 330,000

Going concern contributions:

Present value of existing concern special payments
= 600 * (factor for 156 months using 6% per annum)
= 600 *109.1228
= 65,474

New going concern special payment
= (150,000-65,474)/119.7183
= 706

Solvency contributions:

Present value of existing special payments
= 600*(factor for 60 months using 4.5% per annum) + 706*(factor for 60 months using 4.5% per annum) + 500*(factor for 12 months using 4.5% per annum) +5,000*(factor for 36 months using 4.5% per annum)
= 600*53.756 + 706*53.756 + 500*11.7182 +5,000*33.6625
= 244,377

New solvency special payment
= (330,000-244,377)/53.7576
= 1,593

Minimum contributions for 2011
= 50,000 + (600+706+500+5,000+1,593)*12
= 150,788
= 330,000+50,000
= 380,000

(b) Calculate the 2011 employer contribution.

Funding Policy Contributions
= 2*50,000 + (600+706+500+5000+1,593)*12
= 200,788

5. Continued

(c) The company contributed the contribution determined in part (b) on January 1, 2011 and the asset return in 2011 was 15%. Determine the estimated funded position of the plan as at January 1, 2012 and the 2012 employer contribution.

You are given the following information as at January 1, 2013
Market Value of Assets: $910,000
Going Concern Liabilities: $800,000
Solvency Liabilities: $875,000
Current Service Cost: $60,000

1.1.2012 Assets
= Assets at BOY + Contributions - Benefit Payments + Interest
= 600,000+200,788-10,000 + (600,000+200,788)*0.15-10,000*0.15/2
= $910,200

1.1.2011 Going Concern Liability
= Liabilities at BOY + Current Service Cost - Benefit Payments + Interest
= 750,000+50,000-10,000 + (750,000+50,000)*0.06 -10,000*0.06/2
= 837,700

1.1.2012 Solvency Liability
= Liabilities at BOY + Solvency Incremental Cost - Benefit Payments + Interest
= 900,000+75,000-10,000+ (900,000+75,000)*0.045 -10,000*0.045/2
= 1,008,700

1.1.2012 Going Concern Position
= 910,200 - 837,700
= 72,500

1.1.2012 Solvency Position
= 910,200 - 30,000 - 1,008,700
= -128,500

Contributions:
Plan has a going concern surplus
Going concern special payments no longer required
Plan has solvency deficit of 128,500

Check to see if present value of existing solvency payments as of 1.1.2012 is greater than the solvency deficit present value of existing solvency special payments.
= 5,000*(factor for 24 months using 4.5% per annum) + 1,593*(factor for 48 months using 4.5% per annum)

5. Continued

= 5,000*22.9318 + 1,593*43.9312
= 184,600

Cannot reduce the amount of existing special payments
Can only reduce the period over which these special payments are made

New end date for $5,000 monthly solvency special payment Dec 31, 2012
Check new end date
= 5,000*(factor for 12 months using 4.5% per annum) + 1,593*(factor for 48 months using 4.5% per annum)
= 5,000*11.718 + 1,593*43.9312
= 128,500

Assume 1.1.2012 current service cost as expected: 50,000*(1+0.06)
2012 employer contributions using the funding policy
= 2*50,000*(1+0.06) + 6,593*12
= 185,100

Maximum statutory contributions for 2012
= 128,500+50,000*(1+ 0.06)
= 181,500

Employer can not contribute more than the statutory maximum
2012 employer contributions = 181,500

(d) Calculate the 2013 employer contribution.

1.1.2013 Going Concern Position
= 910,000-800,000
= 110,000

1.1.2013 Solvency Position
= 910,000-30,000-875,000
= 5,000

Plan is in surplus on both going concern and solvency basis.

Plan sponsor is not allowed by the Income Tax act to contribute to the plan if going concern surplus is greater than certain limit (give points on any of the new rule or old rule):

- 0.25 x Going Concern Liabilities or
- min (0.20 x Going Concern Liabilities , max(2*current service cost, 0.10 x Going Concern Liabilities)

Surplus limit = 200,000 or 120,000

5. Continued

Plan is not in excess surplus position.
Maximum 2013 statutory contributions = 60,000
2013 employer contributions using the funding policy = 2*60,000 = 120,000
2013 Contributions = 60,000

6. **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.

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

4. The candidate will understand alternative plan types that occur internationally.

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

(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.

(4a) Compare different plan types and features.

(4b) Give examples of the structure of different plan types.

Sources:

Sharing Risk: The Netherlands' New Approach to Pensions

How to Close the Funding Gap in Dutch Pension Plans?

Allen - Ch. 21

6. Continued

Morneau Sobeco - Ch. 1

Morneau Sobeco - Ch. 12

Commentary on Question:
This question was trying to test students' ability to understand how employer-sponsored pensions are provided in other countries where the legislation, tax, culture and attitude towards programs allow for alternative plan structures.

Further, students were meant to compare inherent risks of these programs with those provided in their own jurisdiction. Finally, students were expected to be able to provide an opinion on the considerations of implementing alternate programs in their own market. It was important for students to understand that "discussing considerations" meant providing an opinion on whether the plan details listed in part (a) could be implemented in their market. Many approached the question as though they would be implementing a plan for one sponsor only, which was not relevant in this instance.

Most candidates were able to clearly compare the risk profile of programs offered in their own jurisdiction.

Many candidates did not write enough details about employer-sponsored arrangements in the Netherlands and didn't show understanding of possible implications for setting up such arrangements in their home country.

Solution:

(a) List the key design characteristics of employer-supported retirement plans now prevalent in the Netherlands.

Commentary on part (a) of Question:
Part (a) was meant to test recollection of information from the two study notes on the Netherlands current employer-sponsored pension model. Candidates were expected to provide design details of the programs.

Prevalent employer supported pension programs in the Netherlands are hybrid DB/DC plans with a career average benefit formula. Coverage is mandatory and is consistent across industry or occupations. Programs are administered by entities separate from employer and employee.
Final pensions are contingent upon plan investment returns as there is a direct correlation between annual contribution and indexation of benefits rates and the plan's current funded status.

Key design characteristics include:

- Uniform accrual rate for all plan members – typically 2% per annum
- Uniform contribution rate set annually for all members

6. Continued

- Uniform indexation rate set annually for all members
- Uniform Asset Mix applies to whole fund – held in a separate trust

(b) Compare and contrast the following plan characteristics:
(i) Investment risk
(ii) Benefit portability
(iii) Plan governance

Commentary on part (b) of Question:
For part (b), students should have been able to combine information from a variety of sources in order to compare and contrast the aspects of each type of program. This requires recollection and synthesis of the material including some explanation of how the different plans relate.

	The Netherlands	**Canadian DB**	**Canadian DC**
Investment Risk	Risk is collectively shared. Risk is more evenly held between active and inactive plan members and employers through impact of funded status on benefits and contributions.	Risk fully borne by employer. Annual employer costs are unpredictable and are increased with poor performance. Most plans are non-contributory for employees.	Risk borne by employee as they choose investment risk level. Significant fluctuation of benefit accruals at retirement. Minimal fiduciary requirements for employer.
Portability	Since 85% are in industry or professional plans, coverage typically extends with change of employer. Standardized design allows for easier portability	Benefits are portable only to other locked in vehicles. Employee risks losing value of future salary increases if FAE.	Relatively little portability issues. Account value moved to other prescribed vehicles. Employer to employer plan transfers not common.

6. Continued

Plan Governance	Policy ladder decision is removed from plan. Plans are also more autonomous being separate from employer. Setting of annual indexation rate and contribution levels is done by plan board. More compromise between union and employers required to enable plan governance.	Mostly conducted by employer. Benefit levels are decided at establishment of plan. Must negotiate with unions at contract renewal which are often contentious.	Employer has some fiduciary and governance responsibility. However, employee is more involved than DB plan due to self-directed investment.

(c) Describe the considerations in implementing the design characteristics in part (a) for single employer defined benefit pension plans in Canada.

Commentary on part(c) of Question:
Many students did not assess changes that would need to take place in the current environment for this type of plan to be supported, nor did they provide a commentary on these changes. For example, few students mentioned that the Netherlands plan structure would not be allowed under current legislative and tax framework, requiring legislative changes. This question required the student to think on a macro level rather than on a plan specific level. This type of change would not be for one sponsor/client, but for all employers in the nation.

- Current Dutch arrangement would not meet Canadian provincial pension legislation requirements e.g. cannot reduce accrued benefits or benefits in payment.
- Nor do they comply with ITA restrictions e.g. PA limits and indexation limits.
- Canadian employers have other goals for retirement programs than simply providing retirement annuities e.g. workforce management, retention, early retirement incentives.
- Implementing this system would require homogenizing benefits that are currently extremely diverse. Higher paid employees may not appreciate one plan for all.
- Canadian employers are looking for ways to share risks with members as seen in the shift to DC plans. So, they would likely be open to considering this type of arrangement. Canadian unions and employees feel the responsibility for under-funding should lie with employer. It would require a shift in mindset to get them to consider sharing over and under-funding risks.

6. Continued

- Canadian funds are responsibility of employer. Dutch pension sponsors are separate, so separate fund providers would need to be set up.
- Dutch unions are required to strike a more even balance between active and retired members so a shift would have to take place in the minds of union members in order for the plans to be successful. A stronger sense of social responsibility exists in the Netherlands so Canadian mindset would have to shift.
- Canadian employees have been looking to take more control over their investment decisions. Implementing the Dutch system would mean that funds are invested in a mixed pool with employees being involved in investment decisions.

7. Learning Objectives:

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

Learning Outcomes:

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

(2c) Explain and test for limits on plan designs and features that protect participant rights.

Sources:

Wyatt Text (Canadian Pensions and Retirement Income Planning)

Commentary on Question:

In this question candidates were asked to determine the maximum pension benefits payable under the terms of the Canadian Income Tax Act under a proposed early retirement window for two sample participants under four possible benefit improvements.

A well prepared candidate would have known the exact terms of the legislation and been able to state the rule and determine if the proposed improvement was possible or not and test it for each of the two sample participants.

In terms of results, candidates did very well at determining the maximum pension benefit; however, they had difficulty determining the maximum bridge benefit for participant A. Candidates also had some difficulty indicating whether the four proposed changes were in excess of the limits or in accordance with the limits for each participant. In some cases, candidates were not familiar with the combined lifetime and bridge benefit test.

Solution:

Calculate the maximum lifetime and bridge benefits that may be paid to Participant A and Participant B and identify which of the enhancements under the proposed early retirement window are in excess of the Permissible Benefits as defined in the *Income Tax Act.*

Maximum lifetime benefit = minimum ($2,552.22,0.02*FAE)*SVC*ERF

FAE = final average earnings
SVC = service
ERF = early retirement reduction of 3% per year from the earliest of age 60, 30 years service and 80 points

Participant A = minimum ($2,552.22, 0.02*40,000) * 15 * (1 - 0.03*5)
= 10,200
Participant B = minimum ($2,552.22, 0.02*65,000) * 15 * (1 - 0.03*5)
= 18,330

7. Continued

Maximum bridge benefit = 12 * (CPP + OAS) * minimum(1,SVC/10) * ERF
CPP = maximum CPP benefit
= 12 * CPP benefit * max(1, (Maximum 3-year salary) / (Last 3-year YMPE))
OAS = maximum OAS benefit
SVC = service
ERF = early retirement reduction of 3% per year from age 60

Participant A
= 12 * (960*(40,000*3/(48,300+47200+46300)) + 524.23) * (1-0.03*(60-55))
= 13,634

Participant B
= 12 * (960 + 524.23) * (1-0.03*(60-58))
= 16,742

Identifying Benefits excess of the permissible benefits as defined in the Income Tax Act.

(i) Maximum pension form for married is joint and survivor 66&2/3 with 5-year guarantee.
Therefore, JS 100% is over maximum allowable benefit for both participants.

(ii) The proposed normal retirement benefit of $15,300 (= $85 * 12 * 15). The maximum limit for participant A is $10,200 and for B is $18,330.
Therefore the proposed benefit for A is in excess of the limit and for B is not in excess of the limit.

(iii) Unreduced pension can be provided at the earliest of age 60, 30 years of service and 80 points.
Therefore, unreduced at age 58 with 20 years of service is beyond the limit for both participants.

(iv) The proposed bridge is $11,700 (= $65 * 15 * 12) for both. The maximum bridge for participant A is $13,634 and for B is $16,742.
Therefore the proposed bridge is acceptable for both participants.

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:

Allen, Chapter 14, p247-260

R-D103-07: Should Variable Pay Count Towards Benefits Calculations?

Morneau Sobeco, 14th Edition, Chapter 11

R-D604-07: Creative Compensation Arrangements for Private Corporations

Watson Wyatt Canadian Pensions and Retirement Income Planning, 3rd Edition, Ch. 14 p.266 , Ch. 15 p.320-322 Ch. 16 P. 332-334 (4th edition Ch. 16 p. 313, Ch. 17 p. 376-378, Ch. 18 p. 390-393)

R-D603-07: Securing Supplemental Retirement Arrangements

R-D602-07: Funding Supplementary Pension Plans

R-D616-09: Executive Compensation

Commentary on Question:

This question tests the candidate's knowledge surrounding executive deferred compensation retirement plans, and supplemental retirement plans.

Candidates were required to recall information surrounding executive compensation including restricted company stock, DC SERPs, and DB SERPs secured through an RCA.

A well prepared candidate compared the potential dollar amounts of compensation under each arrangement, considering the variability/security associated with each component of compensation. Where retirement benefits were provided (as part of the arrangement) the candidate should have discussed security of the benefits, vesting and eligibility, and the adequacy of the retirement benefits. Some mathematical analysis was expected. For options without retirement benefits candidates should have discussed the fact that the executive would be left on their own to save for retirement.

8. Continued

In many cases candidates did not specifically compare potential dollar amounts of compensation under each arrangement. Using a table format to answer this question might have helped candidates organize their thoughts and receive more credit.

Solution:
Your client would like to recruit a 45 year old executive. The company currently provides a competitive health and welfare benefit package and a registered defined benefit pension plan for all employees. The VP of Human Resources has asked you to meet with them to discuss offering the following potential special compensation arrangements to the executive:

(i) $600,000 base salary.

(ii) $400,000 base salary and 50% annual target bonus, half of which is paid in restricted company stock and half of which is paid in cash.

(iii) $350,000 base salary, 50% annual target bonus paid in cash, and an unsecured defined contribution Supplemental Executive Retirement Plan (SERP), with employer contributions equal to 20% of base salary.

(iv) $300,000 base salary, 50% annual target bonus paid in cash, and a 3% final average base salary defined benefit SERP secured through a Retirement Compensation Arrangement (RCA).

Describe the advantages and disadvantages of each arrangement from the executive's perspective.

(i) Base Salary Only

Advantages
All short term compensation - Most secure (nothing deferred or contingent on company's survival)
No attachment to company and future health (e.g. no deferred compensation or unsecured SERP)
Promotes portability of employment (e.g. no vesting requirements)

Disadvantages
Executives left on their own to save for retirement
- If they don't save in respect of non-registered earnings, will face decrease in standard of living in retirement

No incentive to achieve certain company objectives

8. Continued

(ii) Salary plus bonus (paid as stock and cash)

Advantages
Potential for compensation to exceed that provided in (i) - Target Bonus may be exceeded if executive exceeds objectives
Incentive to achieve company/stock performance objectives

Disadvantages
Same target compensation level as in (i) above (i.e., 400,000 + 50% x 400,000)
- Risk for executive if performance objectives are not met for target bonus, compensation will be less than in (i)

Compensation tied to future health of company (there may be vesting requirements before you can cash-in stock)
Executive left on their own to save for retirement in respect of non-registered earnings

(iii) Salary plus bonus and DC SERP

Advantages
DC SERP will provide retirement income security
- Will allow the executive to maintain standard of living in retirement
- May be attractive in that allows the executive to defer income into retirement when tax rate may be lower
- Executive will want to know what the crediting rate is on DC SERP savings

Guaranteed compensation (if you consider DC SERP) is higher than in (i) and (ii) (i.e., 420,000 = 350,000 x 1.2)
DC SERP easy to understand versus DB SERP

Disadvantages
Lower base salary than in (i) and (ii) (i.e., 350K vs. 400K - less certainty in compensation)
Total target compensation is slightly less than in (i) and (ii) (i.e., 595,000 = 350,000 + 50% x 350,000 + 20% x 350,000)
Uncertainty in terms of crediting rate on DC SERP savings
SERP crediting rate may be tied to performance of company
DC SERP, if not secured, is tied to the future health of the company (i.e., if company goes bankrupt, DC SERP funds will be forfeited)
Bonus not covered under SERP

8. Continued

(iv) Salary plus bonus and DB SERP

Advantages

Total target compensation = 450,000 plus a 3% FAE Base Salary RCA secured DB SERP

Question becomes whether the secured DB SERP is worth more than an extra 150,000 of compensation

- Value of DB SERP will depend on future growth in executives base pay
- If past service is provided under DB SERP then will be much more valuable
- Any termination/death/disability benefits will also increase the value of the DB SERP

Attractive because all earnings (other than bonus) will be covered for pension purposes at retirement (i.e., able to maintain standard of living without saving on own)

DB SERP is secured through RCA (i.e., not tied to the future health of the company)

Executive not taxed until receipt of DB SERP

Disadvantages

Lowest base salary and lowest target cash compensation of all approaches

DB SERP may have conditions that tie the executive to the company

- Vesting requirements to retain executive, less job mobility than other compensation approaches
- Eligibility conditions
- Non-compete provisions

RCA funding is expensive and executive may view RCA as not as good a use of compensation dollars

Bonus not covered under DB SERP

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.

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

Learning Outcomes:

(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

(2c) Explain and test for limits on plan designs and features that protect participant rights.

(2d) Test for plan design restrictions intended to control the use of tax incentives.

Sources:

Towers Watson – Canadian Pensions and Retirement Income Planning – Chapters 7, 10, 13, 17, 18

Commentary on Question:

In this question, candidates were asked to improve the ancillary benefits under the NOC's Hourly Plan and determine which two improvements would have the most impact. Similarly, but in the opposite direction, candidates were asked to suggest ways to reduce the costs of the NOC Salaried Plan and determine which two changes would have the most impact.

A well prepared candidate would have been able to describe the various ancillary benefits that are possible to provide in a Canadian pension plan and of these benefits which would have the most value for an Hourly employee group. Also, a well prepared candidate would have been able to demonstrate which plan changes could reduce a plan's cost keeping in mind Canadian pension regulatory requirements.

9. Continued

Candidates did well on part (i) of each parts (a) and (b). However, in both parts (a) and (b), we were looking for candidates to make recommendations and provide support for them in part (ii). Very few candidates provided a recommendation. Candidates were expected to demonstrate awareness of any regulatory restrictions under part (b) where cost reductions were required and also to provide mathematical analysis under part (a) to support which ancillary benefits should be provided.

Solution:
NOC has hired you to conduct a pension plan design review.

(a) NOC wants to increase the value of the ancillary benefits under the Full-Time Hourly Union Pension Plan.

(i) Describe how NOC could change the plan to achieve this, taking into consideration any regulatory constraints.

Early retirement age
Remove age and service requirement
No impact on PA / RRSP room

Normal retirement benefit
Up to 2% x yrs of pensionable service x Highest Indexed Average Compensation
Subject to DB limits in year that benefits commence
Maximums unlikely to apply given NOC's membership
If granted retroactively, will have PA / RRSP room impact

Early retirement benefit
Earliest unreduced value is age 60 / 80pts / 30 year service
At least 3% reduction from earliest of above
No impact on PA / RRSP room

Add a bridge benefit
Max is Max CPP + Max OAS
Max CPP is CPP x min(1,FAE3/FAYMPE3)
Unreduced at age 60 with 10 years service
Reduced 3% per year before age 60
Reduced pro rata if less than 10 years service
Total benefit (Lifetime + Bridge) may be limited
Limit is DB $ limit x service + 25% FA3YMPE x Service / 35
No impact on PA / RRSP room

Form of benefit
Without spouse could add up to 15 year gte

9. Continued

With spouse could increase survival % to 66 2/3%
With spouse could also add up to 5 year gte on the joint and survivor pension
No impact on PA / RRSP room

Post-retirement indexing
Fixed increase to 4%
CPI related up to 100% of CPI
No impact on PA / RRSP room

Pre-retirement indexing
Same rules as post-retirement indexing
No impact on PA / RRSP room

Termination benefit
Any ancillary improves termination benefit CV
No impact on PA / RRSP room
Could be limits on transfer out of DB plan

Pre-retirement death
Pay to spouse and/or dependants
Max to any one is 66 2/3% project retirement benefit
No impact on PA / RRSP room

Disability benefit
Could continue accruing benefit
Could pay disability benefit
No impact on PA / RRSP room

(ii) In your opinion, which two design changes in part (i) would have the most impact.

Normal retirement benefit
Average salary = 53,100 which is 1.8% benefit
So increasing to 2% only about 10% increase
Would also have PSPA impact - not desirable

Early retirement benefit
1/3 to 1/2 can retire much sooner
Maybe 7 years sooner so could be 20% cost
No impact on PA / RRSP room so desirable

9. Continued

Add a bridge benefit
Only of substantial benefit if in addition to early retirement enhancements
Limits would apply and reduce impact
No impact on PA / RRSP room so desirable

Form of benefit
80% married so small increase in sp % or guarantee
So likely of lesser value than other improvements

Post-retirement indexing
CPI assum = 2.5%, but could go up to flat 4% indexing; 1% now so 3% improvement
Can estimate with 3% change in net discount
Duration around 9 years so maybe 30% cost
No impact on PA / RRSP room so desirable

Those with greater value received more points. Any other recommendation with support was also awarded points.

(b) NOC wants to reduce the cost of the Full-Time Salaried Pension Plan.

(i) Describe how NOC could change each of the plan features to achieve this, taking into consideration any regulatory constraints.

Eligibility
Could lengthen for new employees
Max is 2 years continuous employment

Best average earnings
Could lengthen averaging period
Can do for future service only

Definition of earnings
Could limit the earnings that are covered (i.e. base salary only)
Can do for future service only

Normal retirement benefit
Could reduce prospectively
Cannot reduce commuted value of accrued benefit at date of change

9. Continued

Early retirement benefit
Take out early retirement subsidy
Cannot be less than actual equivalent to normal retirement benefit
Can be done retrospectively if not member has not met early retirement eligibility

Form of benefit
Could take out joint and survivor subsidy
Minimum is life only

Disability benefit
Can remove subsidy

Employee contributions
Could add a required annual employee contributions
Limit is min(9% Compensation; $1,000 + 70% of Pension Credit)
Can only do prospectively

Termination of plan
Could freeze accruals
Could go DC in future
Could wind-up the plan
May have other impacts for the Company

(ii) In your opinion, which two design changes in part (i) would have the most impact.

Add employee contributions
Normal cost in area of 18% of pay
So employee contribution could cut cost up to 1/2

Terminate plan
Cannot reduce commuted value of accrued benefit
Cost could be zero for future service
Consider other implications for the company

Any other benefit recommendation
(Note: marks were granted for any other recommendation that included justification and examples of how costs would be reduced)

10. Learning Objectives:

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions
10. The candidate will be able to analyze the relationship of plan investments with plan design and valuations.

Learning Outcomes:

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

(10a) Evaluate the interaction of plan investments and:

- Plan design,
- Plan funding,
- Valuation assumptions, and
- Valuation methods.

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

Sources:

Allen Chapter 24 (pages 445-446)

R-D131-09: Plan Sponsor – Guide to Liability Driven Investing

R-D124-11: Introduction and Overview of Retirement Plan Investing

R-D114-07: An Introduction to Duration for Pension Actuaries

Commentary on Question:

In this question, candidates were asked to demonstrate their knowledge of LDI strategies and duration to hedge a plan's liabilities. A well prepared candidate was expected to list and describe the different LDI strategies and their characteristics. Candidates were also expected to illustrate how to calculate the optimal duration of the asset portfolio and two other approaches to extend duration of the plan in question.

Candidates did very well on this question reflecting the general comfort and awareness of investment knowledge amongst retirement actuaries. Most candidates were able to describe the three LDI strategies and determine the duration of the pension plan in part (b). However, most candidates did not discuss the different methods to extend a plan's duration in sufficient detail.

Solution:

Your client's CFO is considering liability driven investment (LDI) strategies to minimize the volatility of the pension plan's funded status.

10. Continued

(a) List the characteristics of LDI strategies.

Liability Driven Investing

- Coordinates the liabilities and assets
- Tailored to specific plan needs: based on interest rate risk, inflation, plan design features, company qualities, and workforce
- Incorporates both alpha producing and risk mitigation of sponsor's objectives
- Measure of the funded status (not the assets and liabilities) – ratio of market value of assets to market value of liabilities
- Market value of liabilities equal to market derived term structure of interest rates
- LDI performance measure is the liability return - percent change in market value of liabilities
- Success of LDI strategy based on extent that asset return is greater than the liability return
- Increase portfolio duration – increase duration of assets using long bonds, increase number of long bonds or use fixed income derivatives
- Fixed Income derivatives – require liquidity and other types of risk, do not have to sell existing equity or bond positions
- LDI includes three concepts – 1. Must hedge or partially hedge assets, 2. Asset duration can come from securities or interest rate derivatives, 3. Seeking excess return is at the cost of tracking liability risk (tracking error)
- Closer tracking to liabilities, less volatility of contributions
- (Note: marks will also be granted if the candidate mentions that LDI can be costly to implement)

(b) Describe the following LDI strategies:

- Dedication
- Immunization
- Contingent immunization

Dedication

- Cash flow match the liabilities
- Find bonds with similar cash flows as the pension payments
- Principal and coupon payment cover contributions
- Could be very costly to the plan

Immunization

- Portfolio of bonds with market value equal to present value of liabilities
- If interest rates change, ideally the values still match or the assets should be at least as much as the liabilities
- Use duration to determine bond portfolio
- More flexible in constructing the bond portfolio

10. Continued

- Lower cost to sponsor
- Rebalancing required

Contingent Immunization

- Sponsor is willing to accept a minimum rate of return on the bond portfolio 1-2% below current market rate
- Lower market rate provides a safety margin for investment manager to adopt an active management strategy
- If the safety margin is exhausted, the portfolio is still immunized at the minimum rate of return

(c) Calculate the optimal duration of the pension plan assets given the CFO's objective.

Surplus = MV – (Liability active + Liability retiree)

Duration (liability) = (-d (liability)/di)/liability

Duration (MV) = (-d (MV)/di)/MV

Derivation: Duration (MV) = [(liability × dur) of actives + (liability × dur) of retirees)/MV

Calc: Duration = [529(20) + 234(10)]/ (683)

Duration = 18.92 ~ 19

(d) Describe two alternative approaches to extend the duration of the liability hedging portfolio.

1. Purchase long bonds
   - Increase number of long bonds or switch short bonds with long bonds
   - Generates similar cash flow as liability
   - Generally have longer maturity although may be difficult to find many
   - Corporate bonds – mortgage bonds and debenture
   - Government bonds – generally don't want for the portfolio – low yields, taxable income from bond payments

2. Fixed income derivatives
   - Derive their value from another asset
   - Call and put options, futures, convertible bonds, swaps and forwards
   - Call – option to buy an asset at specified price until a specified date
   - Interest rate swaps – one party pays fixed interest and the other pays a floating rate, exchange difference in cash flow

11. 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:

(5c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding and asset valuation methods.

Sources:

Anderson Chapter 2

Commentary on Question:

The purpose of this question is to test the candidates' understanding of liability accrual patterns under various actuarial cost methods.

A well prepared candidate would have demonstrated a good understanding of how cost methods work besides just learning the formula and they would be able to show the pros and cons of using a particular cost method.

Many candidates did not write enough to demonstrate a clear understanding of how the various cost methods develop a plan's liability at retirement and they did not "compare and contrast" the methods as was asked in the question.

Solution:

Compare and contrast the cost and accrual patterns of the following cost methods:

(i) Unit Credit
(ii) Entry Age Normal
(iii) Aggregate

Unit Credit Method

This method is an individual method where the normal cost is equal to the present value of benefits accrued each year.

The normal cost rises more rapidly than salary for individual plan members and for the plan overall. Projected unit credit can be used to mitigate the magnitude of the increase from year to year.

The normal cost under this method is lower in early years, which creates a slower buildup of assets, less interest income and as such greater long term cost of funding.

If there is past service at inception, can cost and amortize separately which provides more funding flexibility.

Entry Age Normal

This method is also an individual method.

The normal cost can be either a level amount or a level percentage of pay, depending on the plan design, which provides funding stability.

11. Continued

Earlier normal cost is higher than under the Unit Credit method, which provides a faster buildup of assets, more interest income and lower long term cost of funding.

If there is past service at inception, can cost and amortize separately which provides more funding flexibility.

Aggregate Method

This method is an aggregate method and is not an appropriate method for small plans.

This method does not provide proper matching of funding to timing of payments.

The normal cost is affected by employer contributions and investment earnings, which creates funding volatility and less funding flexibility.

Past service cost is forced through future normal cost.

12. Learning Objectives:

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

Learning Outcomes:

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

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

Sources:

R-D119-07: Actuarially Equivalent Benefits

Commentary on Question:

The purpose of this question is to test the candidates' understanding of actuarial equivalence and the value of different types of annuity factors.
A well prepared candidate would have been able to equate the optional forms, solve for the various annuity factors, and show the formulas required to solve K. It required recognizing that the member and spouse had the same life only annuity factors.
Almost all candidates solved this question quite easily.

Solution:

A member of a defined benefit pension plan has attained normal retirement age and has elected to retire as at January 1, 2011.

You are given:

Accrued monthly benefit as at January 1, 2011: $5,000 per month

Normal form of payment: Life only, payable monthly

Optional forms of payment: Actuarial equivalent to the normal form of payment assuming 50% male and 50% female unisex mortality

(i) Lump sum of $720,000
(ii) $4,000 per month joint and survivor 100% pension, with a $1,000 per month increase if the spouse dies first; or
(iii) $K per month joint and survivor 50% pension

The member and the spouse are the same age.

Calculate K.

12. Continued

Let $a_x = \ddot{a}_x(12)$ Single life monthly annuity payable as long as member is alive.

Let $a_{xx} = \ddot{a}_{xx}(12)$ Joint life monthly annuity payable as long as member and spouse are alive.

Pension under optional forms should have the same value as the pension payable under the normal form.

Pension x actuarial factor = value
5,000 x 12 a_x = 720,000
a_x = 12

We need to calculate the value of a_{xx}. From the pop-up optional form of pension, we get that:

Value = reduced pension * ax + higher pension * (a_x- a_{xx})
720,000 = 4,000 x 12 x 12 + 5,000 x 12 x 12 - 60,000 a_{xx}
720,000 = 576,000 + 720,000 - 60,000 a_{xx}
576,000 = 60,000 a_{xx}
a_{xx} = 9.6

We can now determine K:

Value = K x 12 a_x + K/2 x 12 (a_x - a_{xx})
720,000 = 12K x 12 + 6K x 12 - 4.8K x 12
720,000 = 13.2K x 12
K = 4,545.42

13. Learning Objectives:

4. The candidate will understand alternative plan types that occur internationally.

Learning Outcomes:

(4b) Give examples of the structure of different plan types.

(4c) Give examples of plans that could work for multinational companies and their employees including third country nationals and expatriates.

Sources:

R-D136-10: The Trend to a Global TCN Benefits Program for US Companies

R-D104-07: The Globalization of Employee Benefits

Commentary on Question:

In this question, candidates were asked to demonstrate an understanding of international issues in developing a pension plan for Third Country Nationals along with key objectives from both an employer and employee perspective. The candidate should be able to extrapolate the knowledge from the readings and provide a sound recommendation for an international plan design

A well prepared candidate would have a good understanding of the different types of pension plans and key objectives of a global plan for Third Country Nationals. Candidate should also understand the different options for providing benefits to TCN's as well as the advantages and disadvantages of each.

A good paper discussed both employer and employee issues for TCNs and had sufficient information for each of parts (a), (b), and (c). It also would have connected the company's global retirement program design recommendations in part (c) to parts (a) and (b). Providing a recommendation in part(c) separated the good candidates from other candidates.

Solution:

(a) Describe, from both an employee and employer perspective, the key pension objectives of a global retirement program for Third Country Nationals.

1. Employer
   - Key objectives:
     - cost effectiveness
     - consideration of all sources of retirement income
     - flexibility
   - ease of administration
   - Costs should be controllable and budgetable
   - retirement program should be structured to recognize "three legged stool" i.e. through social plans, company plan and personal savings

13. Continued

- consideration should be given to the trend of local government shifting financial responsibility to corporate and employee bases

2. Employee
   - Key
     - Transferable benefits between employers
     - Protection from inflation
     - Easy to understand
   - Provide a suitable source of retirement income
   - Need a retirement program that moves with them and will provide a reasonable retirement income when all pieces are considered

(b) Describe the key practical considerations and constraints in implementing a global retirement program.

How employees in IOT will be transferred from NOC's traditional retirement program to the global program

- Consideration given to whether the Plan should be DB or DC
- Plan design should consider the regulatory environment
  - Consideration of the local tax structure
  - Consideration of financing and funding restrictions
- Plan should be integrated with statutory and government-provided benefits
- Review of statutory benefits would include consideration of retirement and old age benefits
- Competitiveness of the Plan design should be considered based on the Local economic and labour environment (but will rarely dictate final plan design)
- Plan design should consider NOC's global benefit objectives
- Consideration given to how the plan should be designed to meet both the employer and employee objectives in part (a)

(c) Propose a global retirement program design for employees in IOT identifying how the program addresses or fails to address the considerations in part (b) and the objectives in part (a).

Design Feature 1 - Plan would be set-up as an international plan for TCN's that provides a plan that moves with employees as they move across geographies to provide a total retirement package.

- International plan must take the regulatory environment into account.

Design Feature 2 - DC plan design rather than DB.
DC Plans meet many of the Employer objectives from part (a) (costs are controllable, flexible and budgetable).

13. Continued

Design Feature 3 -DC contribution formula would be integrated with home country social security. For example, employer contributions of X% of pensionable earnings above the social security wage base.

Design Feature 4 - Employer contribution rate of 10% on pensionable earnings above the social security wage base.

Design Feature 5 - Employee required contribution rate of 3% on pensionable earnings above the social security wage base.
Design considers global benefits objectives from part (b). NOC's mission is to build new offices in Asia and attract top talent. The proposed DC formula would be considered very competitive and the DC structure is consistent with retirement plans in Asia.

Design Feature 6 - Additional matching contributions for **salaried** employees (i.e. NOC matches 50% of employee voluntary contributions up to maximum of 4% if employee contributions 8%).

(Note: Marks were granted if a candidate recommended a plan design and provided reasonable justification with respect to the objectives in part (a) and the considerations in part (b).)

14. Learning Objectives:

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

Learning Outcomes:

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

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

Sources:

CSOP Section 3500 - Pension Commuted Values

Anderson Chapter 4

R-D119-07: Actuarially Equivalent Benefits

Watson Wyatt Canadian Pensions and Retirement Income Planning, 3rd edition – Chapter 17

Commentary on Question:

This question tests the candidate's ability to apply CSOP 3500, calculate lump sum commuted values, and calculate actuarial equivalent optional forms of pension.

This question required a basic pension/bridge calculation, and check that these amounts did not exceed allowable benefits under the Income Tax Act. In determining the lump sum value of the pension and optional forms of pension, the candidate needed to be familiar with formulas under CSOP3500 required to determine partially indexed interest rates. Also, under the lump sum option the candidate had to determine the portion of the lump sum that could be transferred on a registered basis.

The points for this question were fairly evenly distributed between (i) the pension and bridge calculation (ii) determination of partially indexed rates (iii) determination of the JS75% optional form amount of pension and (iv) determination of the lump sum value and portion that may be transferred on a registered basis

In general, most candidates did very well on this question, although some candidates were unable to recall formulas for determining partially indexed interest rates under CSOP 3500.

Solution:

The member retires on November 1, 2011. Calculate and describe the benefits payable under the normal form and each optional form of payment.

14. Continued

(i) Determine the Normal Form pension payable from the Plan at November 1, 2011

Normal Retirement Benefit = 1.5% * FAE2 * credited service * early reduction factor
= 1.5%*(160,000+180,000)/2*30 years*(1-4%*(60-58)-2%*(62-60))
= 67,320

Annual Supplemental Benefit = $5 * 12 * 30 years
= 1,800

Assess for ITA maximum

2011 ITA limit = DB limit * credited service * (1 - ITA ERF)
= 2,552.22 * 30 * [1- (0.25% per month for each year member would have attained earliest of age 60, 30 years of service and 80 points)]
= 2,552.22 * 30 * (1 - 0)
= $76,567

Describe Benefits

Annual Lifetime Benefit is not affected by ITA limit. Annual Lifetime Benefit is $67,320 and annual supplement benefit is $1,800 to age 65 or the earlier of your death

Annual Lifetime Benefit and bridge benefit is not affected by the combined maximum lifetime retirement benefits and bridging benefits rule. Combined maximum lifetime retirement benefits and bridging benefits may not exceed $2,552.22 * 30yrs + 0.25*YMPE3 = 88,383; where YMPE3= 1/3*(48300+47200+46300) = 47,267. The combined benefit does not exceed the limits.

(ii) Determine the interest rates interest rates for commuted value based on CANSIM rates at end of October 2011.

Determine non-indexed rates

$i_{1\text{-}10}$ = i_7 + 0.9%
= 2.88% + 0.9%
= 3.78% ≈ 3.80% (rounded to the nearest 10bps)

i_{10+} = i_L + 0.5 * (i_L - i_7) + 0.9%
= 3.72% + 0.5* (3.72% - 2.88%) + 0.9%
= 5.04% ≈ 5.00% (rounded to the nearest 10bps)

14. Continued

Determine indexed rates

r_7 $= r_L * (i_7 / i_L)$
$= 1.13\% (2.88\%/3.72\%)$
$= 0.87\%$

$r_{1\text{-}10}$ $= r_7 + 0.9\%$
$= 0.87\% + 0.9\%$
$= 1.77\% \approx 1.80\%$ (rounded to the nearest 10bps)

r_{10+} $= r_L + 0.5 * (r_L - r_7) + 0.9\%$
$= 1.13\% + 0.5* (1.13\% - 0.87\%) + 0.9\%$
$= 2.16\% \approx 2.20\%$ (rounded to the nearest 10bps)

Implied inflation rates:

$u_{1\text{-}10}$ $= (1 + i_{1\text{-}10}) / (1 + r_{1\text{-}10}) - 1$
$= 1.0378/1.0177 - 1$
$= 1.97\%$

u_{10+} $= (1 + i_{10+}) / (1 + r_{10+}) - 1$
$= 1.0504/1.0216 - 1$
$= 2.82\%$

80% indexed rates:

$w_{1\text{-}10}$ $= (1 + i_{1\text{-}10}) / (1 + 0.8 * u_{1\text{-}10}) - 1$
$= 1.0378/(1+ 0.8*1.97\%) - 1$
$= 2.17\% \approx 2.20\%$ (rounded to the nearest 10bps)

w_{10+} $= (1 + i_{10+}) / (1 + 0.8 * u_{10+}) - 1$
$= 1.0504/(1+ 0.8*2.87\%) - 1$
$= 2.72\% \approx 2.70\%$ (rounded to the nearest 10bps)

(iii) Determine the J&S 75% optional form

J&S 75% pension $= (\text{Reduced Annual Lifetime Pension} * \ddot{a}_{58}^{(12)})/[\ddot{a}_{58}^{(12)} + 0.75 * (\ddot{a}_{55}^{(12)} - \ddot{a}_{58:55}^{(12)})]$
$= (\$67{,}320 * 18.7) / [18.7 + 0.75*(21.4 - 16.9)$
$= \$57{,}028$

Describe Benefits

Under a J&S 75% optional form selection, the member would receive an amount of $57,028 per annum, payable monthly for their lifetime. Upon the member's death, the spouse would receive $42,771 (75%) per annum, payable monthly for their lifetime. The lifetime pension is indexed at 80% of CPI per annum. The member will receive an annual supplement benefit of $1,800, payable monthly, to the earlier of his death or age 65.

14. Continued

(iv) Lump sum payment of commuted value

Lump Sum payment	= (Reduced Annual Lifetime Benefit * $\ddot{a}_{58}^{(12)}$) + (Supplemental Benefit *$\ddot{a}_{58:7}^{(12)}$)
	= (67,320 * 18.7) + (1,800 * 6)
	=1,269,684
Maximum Transfer Value	=Normal Retirement Benefit * Maximum Transfer Factor @ 58
	=76,500 * 11
	=841,500
Non-locked in	= Lump sum payment - Maximum Transfer Value
	= 428,184

Describe Benefits

Under the lump sum option, the member would receive $841,500 as locked-in funds and the remaining $428,184 as non-locked in funds.