

RET FRC Model Solutions

Fall 2017

1. Learning Objectives:

3. The candidate will understand how to apply/synthesize the methods used to value pension benefits for various purposes.

Learning Outcomes:

- (3b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using a variety of cost methods.

Sources:

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

Commentary on Question:

A well prepared candidate will be able to calculate accrued liability and normal cost using the two specified cost methods.

Solution:

Calculate the total accrued liability and normal cost as at January 1, 2017 using the following methods:

- (i) Individual Level Premium (percent of pay) cost method.
- (ii) Aggregate cost method.

Show all work.

Commentary on Part (i):

Candidates had some difficulty with this part of the question. In some cases the Individual Level Premium (ILP) cost method was used, but on a flat dollar basis, rather than percent of pay. In some other cases, the candidate did not use the ILP method.

- (i) $ILP\ NC = \sum (PVFB_x - AL_x) / PVFS_x \times S_x$ for each member
where
 $PVFB_x = \sum l_y \times q_y \times B_y \times \ddot{a}_y^{(12)} \times v^{(y-x)}$ and $PVFS_x = \sum l_y \times q_y \times S_x \times v^{(y-x)}$

At January 1, 2017, $AL_{2017} = 0$, since this is a new plan.

1. Continued

Employee A: (unreduced retirement at 60)

$$\begin{aligned}PVFB_{\text{ret } 60} &= 75\% \times 100,000 \times 1.04^{10} \times 1.5\% \times 20 \times 14.8 \times v^{10} = 302,611 \\PVFB_{\text{ret } 65} &= (1-75\%) \times 100,000 \times 1.04^{15} \times 1.5\% \times 25 \times 13.5 \times v^{15} = 109,639 \\PVFB_{\text{tot}} &= 302,611 + 109,639 = 412,250\end{aligned}$$

$$[\ddot{a}_{y-x}^j = (1-(1+j)^{-(y-x)})/(1-1/(1+j)) \text{ \& } j = (1.05/1.04)-1]; \text{ so } \ddot{a}_{10}^j = 9.5821 \text{ \& } \ddot{a}_{15}^j = 14.0401$$

$$\begin{aligned}PVFS_{\text{ret } 60} &= 75\% \times 100,000 \times \ddot{a}_{10}^j = 718,658 \\PVFS_{\text{ret } 65} &= 25\% \times 100,000 \times \ddot{a}_{15}^j = 351,002 \\PVFS_{\text{tot}} &= 718,658 + 351,002 = \$1,069,660\end{aligned}$$

$$NC_{2017} = (412,250 - 0) / 1,069,660 \times 100,000 = 38,540$$

Employee B: (unreduced retirement at 63)

$$\begin{aligned}PVFB_{\text{ret } 63} &= 75\% \times 75,000 \times 1.04^8 \times 1.5\% \times 10 \times 14.1 \times v^8 = 110,201 \\PVFB_{\text{ret } 65} &= 25\% \times 75,000 \times 1.04^{10} \times 1.5\% \times 12 \times 13.5 \times v^{10} = 41,404 \\PVFB_{\text{tot}} &= 110,201 + 41,404 = 151,605\end{aligned}$$

$$\begin{aligned}\ddot{a}_8^j &= 7.7384 \text{ and } \ddot{a}_{10}^j = 9.5821 \\PVFS_{\text{ret } 63} &= 75\% \times 75,000 \times \ddot{a}_8^j = 435,285 \\PVFS_{\text{ret } 65} &= 25\% \times 75,000 \times \ddot{a}_{10}^j = 179,664 \\PVFS_{\text{tot}} &= 435,285 + 179,664 = \$614,949\end{aligned}$$

$$NC_{2017} = (151,605 - 0) / 614,949 \times 75,000 = 18,490$$

$$\text{Total } NC_{2017} = 38,540 + 18,490 = 57,030$$

Commentary on Part (ii):

Overall, candidates performed well on this part of the question. Some candidates did not implement the cost method correctly (e.g., not aggregating the salaries). As well, some candidates had minor arithmetic errors (mostly with respect to determining final year's earnings).

$$\begin{aligned}\text{(ii) } \text{Aggr } NC &= (\sum PVFB_x - F_x) / \sum PVFS_x \times \sum S_x \\ \text{where} \\ PVFB_x &= \sum l_y \times q_y \times B_y \times \ddot{a}_y(12) \times v^{(y-x)} \text{ for each member and} \\ PVFS_x &= \sum l_y \times q_y \times S_x \times v^{(y-x)} \text{ for each member}\end{aligned}$$

As a result of the contribution,

$$AL_{2017} = F_{2017} = \$100,000$$

1. Continued

$$\begin{aligned}\sum PVFB_x &= 412,250 + 151,605 = 563,855 \\ \sum PVFS_x &= 1,069,660 + 614,949 = \$1,684,609 \\ \sum S_x &= 100,000 + 75,000 = \$175,000\end{aligned}$$

$$\begin{aligned}NC_{2017} &= (563,855 - 100,000) / 1,684,609 \times 175,000 \\ &= 48,186\end{aligned}$$

2. Learning Objectives:

2. The candidate will understand how to analyze/synthesize the factors that go into selection of actuarial assumptions for funding purposes.
7. The candidate will understand how to apply the standards of practice and professional conduct guidelines.

Learning Outcomes:

- (2a) Describe and apply the techniques used in the development of economic assumptions for funding purposes.
- (2b) Evaluate and recommend appropriate assumptions for funding purposes.
- (7e) Explain and apply all of the applicable standards of practice related to valuing pension benefits.

Sources:

Provisions for Adverse Deviations in Going Concern Actuarial Valuations of Defined Benefit Pension Plans (CIA research paper)

Financial economics and Canadian pension valuations

CIA Consolidated Standards of Practice - Pension Plans 3100-3500 Effective June 9, 2015

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

Commentary on Question:

Candidates were expected to describe appropriate approaches for setting a going concern discount rate and performing valuations under different perspectives and scenarios.

Candidates generally performed well on part (a), but struggled with parts (b) through (d) – mostly due to providing incomplete responses.

In part (b), many candidates failed to explain the equity risk premium and how the perspectives of financial economists differ from those of conventional actuarial practice in this regard. Many candidates also struggled to discuss the basic tenet of pension actuarial practice which requires the consistency of asset and liability valuations, and the financial economics concept of the “pension deal”.

In part (c), most candidates were able to identify two of the approaches, the building block and cash flow matching approaches, and could identify the basic mechanics of each; however, full credit was only awarded to candidates who took a step further and outlined the more complex options (e.g. stochastic modeling, immunization method).

In part (d), most candidates failed to adequately describe the considerations for determining the going concern discount rate under a dynamic investment policy (e.g. asset mix glide path).

2. Continued

Solution:

- (a) List the factors to be considered when determining the margin for adverse deviations for a going concern valuation of a pension plan.
- the asset mix of the plan
 - the maturity of the plan's liabilities
 - the appropriate time horizon for consideration
 - the uncertainty of future plan experience
 - the risk tolerance of plan stakeholders
 - the financial strength of the entity taking contribution risk
- (b) Compare the perspectives of the financial economics framework to conventional actuarial practice for the following:
- (i) The recognition of the equity risk premium when setting a going concern discount rate developed by reference to a pension plan's assets; and
- The equity risk premium is the additional reward that an investor demands for assuming the volatility and forfeiture risk of owning an equity asset
 - **Conventional actuarial practice**
 - is to determine a best estimate of the future return based on estimates of the expected rates of return on the plan's fixed income and equity components.
 - The best estimate, with or without margin, would be used to discount future cash flows to determine the actuarial liability.
 - Typically, the expected return on the equity component would generally be viewed as the return on a long, risk-free asset plus a provision for the equity risk premium.
 - This results in advance recognition and credit for the equity risk premium without valuing the associated assumed risk;

2. Continued

- Financial economists note several violations that stem from the treatment of the equity risk premium in conventional actuarial practice
 - Transfer of risk to future generations (i.e., intergenerational risk transfer)
 - Underpricing of pensions in compensation decisions
 - Biased investment decisions
- **Financial economics framework**
 - Would reflect the value of the equity risk-premium with an equal and offsetting adjustment for the value of the associated risk;
 - which results in the determination of the liabilities where the expected cash flows are discounted using the yields of risk-free fixed income securities (in other words, the market value of the portfolio of assets that replicates the liability obligations); and
- (ii) The consistency of asset and liability valuations
 - A tenet of pension actuarial practice is that assets and liabilities should be valued on a consistent basis.
 - **Financial economics framework**
 - Value of the liability is addressed in a.
 - The value of the assets is unambiguously equal to the market value of the assets determined in the capital markets.
 - The financial economics balance sheet treats the “pension deal” or “promise” as a debt of the corporation/shareholders or at least is “debt like”.
 - **Conventional actuarial practice**
 - Value of the liability is addressed in a.
 - The value of the assets may be equal to the market value of the assets determined in the capital markets or may be an asset value that defers the recognition of certain investment experience.
 - The balance sheet produced by conventional actuarial practice is more in the nature of a budgeting exercise, and is typically used to guide a long-term funding policy (manage the future demand for cash contributions to the pension plan).
 - From a financial economics perspective, conventional actuarial practice smoothed asset values and liabilities are inappropriate and therefore not consistent.

2. Continued

- (c) Describe the two approaches outlined in the CIA Standards of Practice for selecting the best estimate assumption for the going concern discount rate for Plan 1.

Approach 1:

A discount rate based on the expected future investment return on the assets of the pension plan at the calculation date and the expected investment policy after that date.

- **Building Block Method:** Determine best estimate of long-term, expected future investment returns for various asset classes based on investment policy and adjust for:
 - the expected effects of rebalancing and diversification;
 - the inclusion of an allowance for additional return due to active versus passive management, where appropriate and where relevant supporting data exists;
 - an appropriate provision for expenses paid from the Plan;
 - a margin for adverse deviations, as appropriate; and
 - rounding, as appropriate (typically to the nearest 0.10% or 0.25%).
- **Stochastic Method:** Use a logically constructed stochastic asset model (which directly incorporates the effects of diversification and rebalancing) to calculate the best estimate return assumption based on a percentile at or near the median of the distribution of long-term investment returns of the portfolio. Adjusted for expenses and rounding, as appropriate.

Approach 2:

A discount rate based on the yields of investment grade debt securities, considering the expected future benefit payments of the pension plan (i.e. matching projected cash flows or duration), regardless of the plan's assets.

- **Select and Ultimate Method:** Select and ultimate rates may be used to approximate the effect of using a full yield curve. Adjusted for expenses and rounding, as appropriate.
 - **Immunization Method:** For a plan with an immunized portfolio, it may be appropriate to base the discount rate assumption on the yield on the immunized portfolio. If the fixed income investments mature prior to the expected payment of all projected benefit cash flows, the actuary would consider making an allowance for reinvestment and the effect of possible changes in interest rates on future investments. Adjusted for expenses and rounding, as appropriate.
- (d) Describe the considerations for selecting the best estimate assumption for the going concern discount rate for Plan 2.

2. Continued

- Discount rate may be determined based on the yields of investment grade debt securities, with cash flows matching the projected benefit payments of Plan 2.
- Discount rates may be determined by modeling the evolution of the going concern funded ratio
 - to determine expected future investment returns that reflect the change to the target asset mix (increase the bond allocation by 10%, decrease equity allocation by 10%) at each projected “trigger date” (5% increase in going concern funded ratio) under the “glide-path”
- The going concern funded ratio could be projected where the going concern liabilities reflect:
 - the closed nature of the plan
 - expected normal cost
 - expected benefit payments
- The going concern funded ratio could be projected where the going concern assets reflect:
 - Expected employer contributions (normal cost and deficit funding) considering the plan’s funding policy and regulatory funding requirements
 - Expected employee contributions
 - Expected benefit payments
 - Expenses not reflected in the expected rate of return
- the resulting discount rates will be for various periods and would eventually reach an ultimate rate once the expected going concern funded ratio reaches 110%, where the asset mix would be 100% fixed income

3. Learning Objectives:

3. The candidate will understand how to apply/synthesize the methods used to value pension benefits for various purposes.

Learning Outcomes:

- (3b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using a variety of cost methods.
- (3d) Perform valuations for special purposes, including:
- (i) Plan termination/wind-up/conversion valuations
 - (ii) Hypothetical wind-up and solvency valuations
 - (iii) Open group valuations
 - (iv) Share risk pension plan valuations

Sources:

FR-104-13: Pension Projections (Appendix for Background Only)
ASOP 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions

Commentary on Question:

Candidates were expected to identify and describe the main differences between deterministic and stochastic projections in this question.

Part (a) was generally done well, but candidates had difficulty with parts (b) and (c). In part (b), full credit was not awarded if the candidate simply described what a stochastic projection is, as opposed to the actual process/steps needed in order to perform the stochastic projection.

In part (c), many candidates struggled to identify the benefits of performing stochastic projections, despite having listed helpful/guiding limitations of deterministic projections in part (a).

Solution:

- (a) List the limitations of using a single set of deterministic assumptions for your projections.
- Results of deterministic projections are presented under a single scenario, which will never be fully realized
 - Results do not show the impact of assumption changes and possible alternate events
 - Difficult to assess the probability of alternate scenarios
 - No stress testing and assessment of the risk tolerance

3. Continued

- (b) Describe the process to perform stochastic projections.
- The first step is to define the scope of the project to determine which items will be analyzed
 - Determine the assumptions to be used in projecting the population forward
 - Collect the data, if applicable. The data might already be available to the actuary.
 - Produce liability streams that will be needed for the deterministic part of the projection

 - Combine the results with the projected returns on assets to produce valuation results.
 - Determine various assumption changes and scenarios to be performed for stochastic projection purposes, and determine the probability associated with each.
 - Perform the analysis under each scenario and package the results to get the stochastic projection results.
- (c) Explain how performing stochastic projections would address the limitations in (a).
- The results of stochastic projections are presented under a range of results, with greater likelihood that actual experience falls within the range contemplated.
 - The use of stochastic projections allows reflecting correlations between assumptions, allowing for more detailed analysis of the results.
 - The results allow the plan sponsor to assess the volatility and impact of assumptions changes and alternate events such as changes in:
 - funding policy,
 - investment policy,
 - plan provisions
 - future economic situations
 - demographic trends
 - The results of stochastic projections allow the plan sponsor to assess the probability of alternate scenarios happening, and show confidence intervals.
 - Provide sensitivity analysis, including scenarios with very favorable and very unfavorable results, to help assess risk exposure and risk tolerance.
 - Provides ability to perform detailed analysis for plan sponsors to take complex decisions.

4. Learning Objectives:

3. The candidate will understand how to apply/synthesize the methods used to value pension benefits for various purposes.

Learning Outcomes:

- (3c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding and asset valuation methods.

Sources:

Canadian Institute of Actuaries' revised Educational Note Guidance on Asset Valuation Methods

Commentary on Question:

The purpose of this question was to test candidate's ability to understand the components of a good asset smoothing method and analyzing the chosen asset valuation method to whether it meets the criteria. Candidates were also asked to calculate the smoothed asset value using the requested method.

Solution:

- (a) List the desirable characteristics of an asset valuation method in accordance with the Canadian Institute of Actuaries' revised Educational Note Guidance on Asset Valuation Methods.

Commentary on Question:

Full marks were given if candidates listed all seven points.

- Achieves objective of moderating volatility of contributions
 - Tracks to market value
 - Does not unduly deviate from market value
 - Has a reasonable and logical relationship to market value
 - Is generally free of any bias
 - Has no undue influence on investment transaction decisions or vice versa
 - Is consistent with the length of typical economic cycles, typically not more than 5 years.
- (b) Calculate the smoothed actuarial value of assets at the valuation date (beginning of Year 4).

Show all work.

Calculate the rate of return for each year

Year n: $2 \times \text{Interest, Realized and Unrealized gains/(losses)} / (\text{BOY MV} + \text{EOY MV} - \text{Interest, Realized and Unrealized gains/(losses)})$

Year 1: $2 \times 11,000 / (200,000 + 241,000 - 11,000) = 5.1163\%$

Year 2: $2 \times -26,000 / (241,000 + 255,000 - -26,000) = -9.9617\%$

Year 3: $2 \times 38,000 / (255,000 + 307,000 - 38,000) = 14.5038\%$

4. Continued

Calculate the value of a unit

$$\text{Year 2: } 1000 \times (1 + 5.1163\%) = 1,051.163$$

$$\text{Year 3: } 1051.163 \times (1 + -9.9617\%) = 946.449$$

$$\text{Year 4: } 946.449 \times (1 + 14.5038\%) = 1,083.720$$

Calculate the number of units for each year

$$\text{Year 2: } 200 + 30,000/1,000 = 230.00$$

$$\text{Year 3: } 230 + 40,000/1,051.163 = 268.053$$

$$\text{Year 4: } 268.053 + 14,000/946.449 = 282.845$$

Determine the Actuarial Value of Assets

$$\text{Average value of a unit: } (1,000 + 1,051.163 + 946.449 + 1,083.720)/4 = 1,020.333$$

$$\text{AVA: } 282.845 \times 1,020.333 = \mathbf{\$288,596}$$

- (c) Critique the above smoothing asset valuation method taking into consideration the Canadian Institute of Actuaries' revised Educational Note Guidance on Asset Valuation Methods.

Commentary on Question:

Overall this part of the question was done poorly. Marks were not given for simply restating the criteria from part A. Marks were given where clear reasons provided support to the criteria from part A.

1. Moderates the volatility of contributions because
 - since AVA is calculated using the average unit value, the investment returns are smoothed over 4 years
 - whereas MV is determined by actual return in a single year.
2. Tracks to market value because
 - at inception, the AVA is set equal to the MV
 - the unit value tracks the actual return, and
 - the net cash flow in the fund is included in the number of units
3. May deviate from MV
 - if actual returns are consistently high or low during the 4-year period, there is a lag in the AVA in catching up with MV
 - there is no corridor limit in the method.
4. There is a reasonable and logical relationship to market value
 - beginning unit value based on market value in the first year
 - both market value and unit value change with the same actual return of the previous year and with the same net cash flow

4. Continued

5. Free of bias because the actuarial value is not constrained to be a fixed percentage of market value and is not unbalanced in favour of a higher or lower value than the market value.
6. Should not affect investment decisions. Gains include both realized and unrealized gains.
7. The method covers 4 years and therefore satisfies the recommendation of the CIA that the economic cycle should not extend more than 5 years.

5. Learning Objectives:

4. The candidate will understand the principles and rationale behind regulation.
5. The candidate will understand how to evaluate and apply regulatory policies and restrictions for registered retirement plans.

Learning Outcomes:

- (5c) The candidate will be able to describe and apply regulation pertaining to plan amendment.
- (5g) The candidate will be able to describe and apply regulation pertaining to reporting requirements.
- (5i) The candidate will be able to describe and apply regulation pertaining to contributions and benefits.
- (5k) The candidate will be able to describe and apply regulation pertaining to coordination of individual and employer sponsored retirement plans.

Sources:

Canada Revenue Agency PSPA Guide; and
Towers Watson (5th edition) Chapter 10 on *Past Service Pension Adjustments*

Commentary on Question:

The purpose of this question was to test candidates' understanding of the principles and rationale behind the PSPA calculations and application. Overall, candidates did not perform well on this question (see commentary under each part of the question).

Solution:

- (a) Explain the principles behind Past Service Pension Adjustment (PSPA) calculations.

Commentary on Question:

Candidates generally did not perform well on this part because they did not explain the principles behind PSPA calculations (i.e., the tax implication and impact on a member's RRSP room, or described PA without reference to PSPA). Many candidates also answered this question by comparing the difference between Pension Adjustments (PA) and PSPAs, without explaining the principles behind PSPAs.

- Past Service Pension Adjustment (PSPA) was introduced to ensure equitable access to tax-assisted retirement savings and to ensure equity within the PA system.

5. Continued

- PSPA measures how much PAs are undervalued when past benefit improvements are provided; and was introduced to avoid "double-dip" (e.g., for member who made maximum contributions to an RRSP each year, and employer later set up a pension plan to include past benefit upgrade).
 - PSPA reduces (or eliminates) any RRSP carry-forward an individual may have and can cause RRSP contribution room to become negative.
 - Two scenarios where PSPAs (applicable to defined benefit pension plans only) are generated:
 - Credits additional periods of past service after 1989
 - Benefits are retroactively improved
 - Improving benefits for service prior to 1990 does not result in a PSPA, since the first PAs were in respect of calendar year 1990.
 - Two different methodologies: the basic approach (when the past service event occurred) and the modified approach (reciprocal transfer or portability situations).
 - Ancillary benefits generally have no impact on the calculation of the PA (except for an introduction to an optional form of pension for retirees which may lead to higher initial lifetime pension).
 - PSPA may need to be certified. Certification means pre-approval by the CRA that the individual has sufficient RRSP contribution room to permit the service to be credited.
 - The PSPA (non-exempt) may even lead to the member having to make a choice between deregistering some RRSP assets, or member not receiving the benefit improvement.
- (b) Calculate the provisional PSPA if the member decides to buy back all leaves of absence.

Show all work.

5. Continued

Commentary on Question:

Candidates generally did well on calculating components “A” and “B” in the formula (i.e., PAs before and after amendments). Some candidates calculated A and B above without including the years that were not affected by the past service event or service buy-back (i.e. year 2011), which is acceptable, as the question asked for the calculation of PSPA. However, many candidates did not get the correct PSPA because they confused components “C” and “D” in the formula, or did not understand what constitutes a qualifying transfer (i.e., component C).

- The basic formula is used in this case: $A - B - C + D$, where
 A = sum of recalculated PAs
 B = sum of the reported PAs and PSPAs
 C = amount of any “qualifying transfer” the individual has made to the plan to fund the additional benefits.
 D = amount of any “excess money purchase transfer”.
- PSPA Calculations using formula: $A - B - C + D$

Year	A	B	C	D	=	PSPA
2011	\$9,228	\$9,228	\$0	\$0	=	\$0
2012	\$9,228	\$0	\$3,640	\$0	=	\$5,588
2013	\$9,228	\$0	\$3,640	\$0	=	\$5,588
2014	\$11,064	\$10,200	\$0	\$0	=	\$864
2015	\$11,064	\$0	\$4,320	\$0	=	\$6,744
2016	\$12,023	\$10,875	\$0	\$0	=	\$1,148
Total	\$61,835	\$30,303	\$11,600	\$0	=	\$19,932

Details of each step are provided below:

- Step 1: Re-calculate member's benefit earned and past credit taking into past event (i.e. bonuses + service buy-back)

Pension Credit after Plan amendment (A)

$$2011 = 0.015 \times \$72,800 \times 1 \times 9 - 600 = \$9,228$$

$$2012 = 0.015 \times \$72,800 \times 1 \times 9 - 600 = \$9,228 \text{ (buy-back)}$$

$$2013 = 0.015 \times \$72,800 \times 1 \times 9 - 600 = \$9,228 \text{ (buy-back)}$$

$$2014 = 0.015 \times \$86,400 \times 1 \times 9 - 600 = \$11,064 \text{ (bonus)}$$

$$2015 = 0.015 \times \$86,400 \times 1 \times 9 - 600 = \$11,064 \text{ (bonus + buy-back)}$$

$$2016 = 0.015 \times \$93,500 \times 1 \times 9 - 600 = \$12,023 \text{ (bonus)}$$

5. Continued

- Step 2: Calculate the member's benefit earned and pension credits based on benefits provided immediately before the past service event

Pension Credit before Plan amendment (B)

$$2011 = 0.015 \times \$72,800 \times 1 \times 9 - 600 = \$9,228$$

$$2012 = 0$$

$$2013 = 0$$

$$2014 = 0.015 \times \$80,000 \times 1 \times 9 - 600 = \$10,200$$

$$2015 = 0$$

$$2016 = 0.015 \times \$85,000 \times 1 \times 9 - 600 = \$10,875$$

- Step 3: Calculate any qualifying transfer to fund the past benefit

Qualifying Transfer (C)

$$2011 = 0$$

$$2012 = 0.05 \times \$72,800 = \$3,640 \text{ (buy-back)}$$

$$2013 = 0.05 \times \$72,800 = \$3,640 \text{ (buy-back)}$$

$$2014 = 0$$

$$2015 = 0.05 \times \$86,400 = \$4,320 \text{ (buy-back)}$$

$$2016 = 0$$

- Step 4: determine any excess money purchase transfer

Excess Money Purchase Transfer (D) for all years = 0

Bonus points given to candidates providing comments about the member's contribution room and RRSP account balance:

- PSPA is less than contribution room of \$40,000; and the contribution room will be reduced by \$19,932 to \$20,068.
- Based on data provided, the member has sufficient money to transfer from his RRSP to the RPP (as qualifying transfer).

- (c) Describe the PSPA certification process.

Commentary on Question:

Most candidates did not perform well on this question because they did not describe the certification process. Candidates did not get points if they described the conditions when the PSPA is exempted from certification, nor if the candidates described the PSPA reporting process.

5. Continued

- Administrator calculates the PSPA for the affected individual
- Reports the PSPA to CRA on a specified form T1004, Applying for the Certification of Provisional Past Service Pension Adjustment.
- CRA compares the PSPA to the individual's RRSP contribution room.
- CRA generally approves the certification if the PSPA is less than the individual's RRSP contribution room, or no more than \$8,000 greater than the amount of available contribution.
- If the PSPA is certified, then the RRSP room is reduced by the PSPA.
- The individual may need to deregister an appropriate amount of RRSP assets.

6. Learning Objectives:

3. The candidate will understand how to apply/synthesize the methods used to value pension benefits for various purposes.

Learning Outcomes:

- (3e) Calculate actuarially equivalent benefits.

Sources:

Actuarial equivalence calculation , Canadian Pensions and retirement income planning (Towers book – 5th edition) chpt – 17

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Calculate the member's annual pension benefit under the normal form of pension at the member's postponed retirement age.

Show all work.

Commentary on Question:

Some candidates were unable to correctly identify the actuarial equivalence formula.

$$\begin{aligned} \text{a. Pension benefit at postponed retirement date} \\ &= 2\% * \text{Final Average Earnings} * \text{Years of Service} \\ &= 0.02 * 54,000 * 26 \\ &= 28,080 \end{aligned}$$

- b. Calculate the actuarial equivalent of normal retirement benefit

$$\begin{aligned} \text{Pension benefit at normal retirement date} \\ &= 0.02 * 51,000 * 24 \\ &= 24,480 \end{aligned}$$

$$\begin{aligned} \text{Actuarial equivalent of normal retirement benefit} \\ &= 24,480 * (\text{annuity factor at 65} / \text{annuity factor at 67}) * (1 + i)^{(67-65)} * (1/{}_2P_{65}) \\ &= 28,537 \end{aligned}$$

$$\begin{aligned} \text{Pension at Postponed retirement (life only, LO)} &= \text{maximum (a,b)} \\ &= \max (28,080, 28,537) \\ &= 28,537 \end{aligned}$$

6. Continued

- (b) Explain, in words, the impact on the member's postponed retirement pension if mortality rates are improved.

$$\bullet \quad BP_x = AP_y * [a^{(12)}_y / a^{(12)}_x * (1+i)^{x-y}] * [1/({}_{x-y}p_y)] \text{ where}$$

BP_x = the annual pension benefit at late retirement

AP_y = annual benefit at normal retirement

- Actuarial increase is due to interest accumulation and benefit of survivorship
- If mortality rates improved, the benefit of survivorship is reduced and therefore, overall impact of the annual pension benefit at late retirement will be reduced

- (c) Calculate the member's annual pension benefit under the elected pop-up optional form of payment at the member's postponed retirement age.

Show all work.

Commentary on Question:

Many candidates were unable to identify the correct formulas (covered in the study material) to complete the question.

Determine joint and survivor annuity factor

$$LO * a^{(12)}_{67} = JS60\% * [a^{(12)}_{67} + .6 * (a^{(12)}_{67} - a^{(12)}_{67:67})]$$

$$LO * a^{(12)}_{67} = 0.92 * LO * [a^{(12)}_{67} + .6 * (a^{(12)}_{67} - a^{(12)}_{67:67})]$$

$$a^{(12)}_{67} / 0.92 = a^{(12)}_{67} + .6 * (a^{(12)}_{67} - a^{(12)}_{67:67})$$

$$a^{(12)}_{67} / 0.92 - a^{(12)}_{67} = .6 * (a^{(12)}_{67} - a^{(12)}_{67:67})$$

$$(a^{(12)}_{67} / 0.92 - a^{(12)}_{67}) / .6 = a^{(12)}_{67} - a^{(12)}_{67:67}$$

$$a^{(12)}_{67:67} = a^{(12)}_{67} - (a^{(12)}_{67} / 0.92 - a^{(12)}_{67}) / .6$$

$$a^{(12)}_{67:67} = 12.05652$$

calculate pop up pension (PU)

$$LO * a^{(12)}_{67} = 0.6 * PU * a^{(12)}_{67} + 0.4 * PU * a^{(12)}_{67:67} + LO * (a^{(12)}_{67} - a^{(12)}_{67:67})$$

$$PU = LO * a^{(12)}_{67:67} / (0.6 * a^{(12)}_{67} + 0.4 * a^{(12)}_{67:67})$$

$$PU = 25,903$$

7. Learning Objectives:

5. The candidate will understand how to evaluate and apply regulatory policies and restrictions for registered retirement plans.

Learning Outcomes:

- (5a) The candidate will be able to describe and apply regulation pertaining to plan design.
- (5i) The candidate will be able to describe and apply regulation pertaining to contributions and benefits.

Sources:

Towers Watson (5th edition) Chapter 17 titled
Registration Rules for Defined Benefit RPPS – Permissible Benefits

Commentary on Question:

The purpose of this question is to test candidates' understanding of the limits imposed by the Income Tax Act (Canada) on permissible benefits allowed to be provided by registered defined benefit pension plans. Candidates generally did well on the first part of the question. Many candidates mixed up the different type of service (continuous versus credited services) to be used in the different applicable formulas, and therefore did not get the right answers to the calculations.

Solution:

- (a) Assess whether or not each of the requested plan provisions are permitted under the Income Tax Act for a registered pension plan.

Justify your response.

Commentary on Question:

Candidates generally understand the maximum permitted benefits/ pension forms allowed under the ITA. However, full points were not given for the following common reasons:

- *The maximum pension accrual rate is 2% of highest average 3-year indexed compensation (not FAE);*
- *Candidates missed to comment on the combined (lifetime pension and bridge combined) maximum under the ITA, which sets a limit on the bridge benefit; and*
- *Candidates did not comment on the conditions imposed by the ITA if a survivor pension is payable to an eligible dependent.*

7. Continued

Lifetime Benefit maximums

3% accrual rate not permitted under the ITA:

- Accrual: Maximum pension accrual rate under an RPP is 2% of highest average 3-year indexed compensation (non-overlapping 12 month periods indexed to AIW)
- Dollar maximum: Further there is a dollar maximum lifetime benefit, set out under the ITA (“ITA Max”) for each year of credited service. Given the high salary of the CEO he would be capped at this maximum.

Unreduced pension at age 57 not permitted for CEO under the ITA:

- Early Retirement Reductions: the maximum benefit is reduced for commencement prior to the earlier of age 60, 30 years of service from hire and 80 age plus service points. The reduction is 0.25% per month prior to the date that the member would have been entitled to an unreduced maximum pension, had they remained employed.
- The CEO does not meet any of the above criteria for an unreduced pension:
 - Age = 57
 - Continuous service = 20
 - Points = 77

Bridge and Combined Maximums

Requested bridge not permitted under the ITA, it exceeds the max and combined max under the ITA and the age limit:

- Maximum bridge: OAS plus CPP in the year of retirement, payable to no later than age 65. The bridge must be reduced by 0.25% per month for each month a plan member is under age 60 at commencement. The max bridge is also reduced on a prorated basis for pensionable service less than 10 years.
- Combined Maximum: There is a combined maximum between pension and bridge benefits such that the CEO’s lifetime pension plus his bridge amount cannot exceed the ITA Max pension times credited service plus (25% of average 3 year YMPE) times (credited service (to max of 35 years)/ 35) prior to age 65.

7. Continued

Payment Options and Cost of Living Adjustments

Payment form potentially permitted on a temporary basis under the ITA:

- Survivor payments from a joint and survivor pension (to maximum of 66.67% guaranteed for 5 years without reduction) may continue for the lifetime of a spouse;
- A survivor pension may be payable to a dependent to the later of age 18, the date the dependent ceases to be a fulltime student, or in the case that the dependent is infirm, the period in which the dependent remains infirm.

Flat Rate 5% indexation not permitted under the ITA:

- Indexation adjustments are limited to:
 - Fixed annual indexation cannot be larger than 4% per year
 - Any COLA is limited to the maximum lifetime pension in the year of commencement, adjusted to reflect increases in CPI
- (b) Calculate the maximum lifetime pension and bridge benefits payable to the CEO under a registered plan as at January 1, 2017.

Show all work.

Commentary on Question:

Many candidates did not get the correct answers because they mixed up the use of credited services and continuous services in the different parts of the formulas. For example, credited service shall be used to determine the maximum lifetime pension and combined maximum pension; and continuous service shall be used to determine the early retirement reduction factor.

Maximum Lifetime Pension:

- Dollar Cap = DB dollar limit x credited service = $\$2914.44 \times 7 = \$20,401.08$
- Reduction on lifetime pension = $\text{Min}(60 - 57, 30 - 20, (80 - 77)/2) \times 0.03 = 4.5\%$; where the 30/60/80 rules are determined based on continuous service.
- Total annual maximum lifetime pension payable at January 1, 2017 is:
 $\$20,401.08 \times (1 - 4.5\%) = \$19,483$

7. Continued

Max Bridge (before combined maximum):

- Dollar Cap = (OAS + CPP) = \$13,370 + \$6,942 = \$20,312 per annum
- Reduction:
 - Proration: $\min(7,10)/10 = 0.70$;
 - Age: $(60-57) \times 0.03 = 9.0\%$
- Total annual bridge payable to age 65 is: $\$20,312 \times 0.70 \times (1 - 9.0\%) = \$12,939$

Combined Maximum Pension (payable before 65):

- DB dollar limit x credited service + 25% of Average YMPE3 x credited service (capped at 35 years) / 35
$$\$2,914.44 \times 7 + (\$54,600 \times 25\% \times \min(7,35)/35) = \$23,131$$
- Capped Bridge: Min(Max Dollar bridge, difference between combined max and lifetime pension)
- $\text{Min}(\$12,939, \$23,131 - \$19,483) = \$3,648$

8. Learning Objectives:

2. The candidate will understand how to analyze/synthesize the factors that go into selection of actuarial assumptions for funding purposes.

Learning Outcomes:

- (3b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using a variety of cost methods.

Sources:

Pension Mathematics for Actuaries, Anderson, Third Edition, 2006, Chapter 2.
FR-132-17: A Problem-Solving Approach to Pension Funding and Valuation, Second Edition, Ch.5.

Commentary on Question:

The successful candidate would demonstrate that they can apply the EAN cost method and calculate the liabilities and financial position at various dates. Candidate should recognize that the normal cost for all three individuals is the same given the same entry age. In addition, the successful candidate will be able to identify and calculate the sources of gains and losses due to membership movements as described in the question.

Solution:

- (a) Calculate the unfunded actuarial liability and the normal cost as at January 1, 2017.

$$\begin{aligned} \text{EAN NC} &= \text{PVFB}_w / \text{PVFY}_w = \text{PVFB}_w / \ddot{a}_{(y-w)} \rfloor \\ \text{PVFB}_w &= 100 \times 12 \times (1 - .03 \times 5) \times (60 - 25) \times \ddot{a}_{60}^{(12)} \times v^{35} \\ &= 100 \times 12 \times .85 \times 35 \times 14.8 \times .18129 \\ &= 95,787 \\ \text{PVFY}_w &= \ddot{a}_{35} \rfloor = (1 - v^{35}) / (1 - v) = 17.1929 \\ \text{NC}_w &= 95,787 / 17.1929 = 5,571 \\ \text{AL}_A &= \text{NC}_w * S(\text{due}, n=10, i=5\%) = 5,571 * 13.206 = 73,578 \\ \text{AL}_B &= \text{NC}_w * S(\text{due}, n=20, i=5\%) = 5,571 * 34.719 = 193,431 \\ \text{AL}_C &= \text{NC}_w * S(\text{due}, n=29, i=5\%) = 5,571 * 65.439 = 364,579 \\ \text{Total AL} &= 631,588 \\ \text{UAL} &= \text{AL} - F = 631,588 - 650,000 = (18,412) \\ \text{NC} &= 5,571 \times 3 = 16,713 \end{aligned}$$

- (b) Calculate the unfunded actuarial liability as at January 1, 2018.

8. Continued

$$\begin{aligned}AL_A &= 0 \\AL_B &= (193,431 + 5,571) \times 1.05 = 208,952 \\ \text{Member C:} \\ \text{Pension} &= 100 \times 12 \times (1 - .03 \times 10) \times (55 - 25) \\ &= 25,200 \\AL_C &= 25,200 \times \ddot{a}_{55}^{(12)} \\ &= 25,200 \times 16.0 \\ &= 403,200 \\ \text{Total AL} &= 208,952 + 403,200 = 612,152 \\ F &= 650,000 - 50,000 = 600,000 \\ \text{UAL} &= \text{AL} - F = 612,152 - 600,000 = 12,152\end{aligned}$$

- (c) Calculate the gains or losses, by source, for 2017.

Show all work.

$$\begin{aligned}\text{Expected UAL} &= (18,412) \times 1.05 \\ &= (19,333)\end{aligned}$$

$$\text{Gains/(Losses)} = (19,333) - 12,152 = (31,485)$$

Gain on termination – Member A:

$$\begin{aligned}\text{Exp'd AL} &= (73,579 + 5,571) \times 1.05 \\ &= 83,108 \\ \text{Gain/(Loss)} &= \text{AL} - \text{Refund} \\ &= 83,108 - 50,000 = 33,108\end{aligned}$$

Loss on retirement – Member C:

$$\begin{aligned}\text{Exp'd AL} &= (364,578 + 5,571) \times 1.05 \\ &= 388,656 \\ \text{Gain/(Loss)} &= \text{Exp'd AL} - \text{Act'l AL} \\ &= 388,656 - 403,200 = (14,544)\end{aligned}$$

Loss on contributions:

$$\begin{aligned}\text{Exp'd NC} &= 16,713 \times 1.05 \\ &= 17,549 \\ \text{Act'l Conts} &= 0 \\ \text{Gain/(Loss)} &= 0 - 17,549 = (17,549)\end{aligned}$$

8. Continued

Loss on fund return:

$$\text{Act'l F} = 600,000 \text{ (see above)}$$

$$\text{Expected F} = 650,000 \times 1.05 - 50,000$$

$$= 632,500$$

$$\text{Gain/(Loss)} = 600,000 - 632,500 = (32,500)$$

Check:

$$\text{Gains/(Losses)} = 33,108 + (14,544) + (17,549) - (32,500) = (31,485)$$

9. Learning Objectives:

6. The candidate will understand how to apply the regulatory framework in the context of plan funding.

Learning Outcomes:

- (6b) Evaluate funding restrictions imposed by regulations.

Sources:

FR-135-17: Quebec: Adoption of Bill 57 to amend pension plan funding

FR-136-17: Quebec: Regulation respecting the stabilization provision for private sector pension plans

FR-137-17: Québec: Retraite Québec provides details about the new rules

FR-114-17: Ontario Pension Benefits Act R.R.O. 1990, Reg 909

FR-115-17: Ontario Pension Benefits Act, R.S.O. 1990, Ch. P.8

Commentary on Question:

Successful candidates will be able to use the available information to calculate the minimum required contributions applicable to a registered plan with employees reporting to work in Quebec or in Ontario.

Solution:

- (a) Calculate the minimum contributions required for 2017 where the client has elected to reflect no margin for adverse deviation in the going concern discount rate.

Show all work.

Commentary on Question:

Candidates generally had difficulty with this part of the question. Although many candidates were able to calculate the stabilization provision, they often did not apply it correctly (e.g., confusing for which of the normal cost or going concern liabilities to use the 5% offset) or did not apply it at all.

Asset duration: $45\% * 7.8 = 3.51$

Ratio of asset duration to liability duration: $3.51 / 20.0 = 17.55\%$

Variable income %: 50%

Stabilization Provision (SP): $17 * (25 - 17.55)/(25 - 0) + 15 * (17.55 - 0)/(25 - 0)$
 $= 15.6\%$

9. Continued

Normal Cost contribution with SP

NC = \$82,000

SP % to be applied to NC is 15.6%

Total Normal Cost = $\$82,000 * (1 + 15.6\%) = \$94,792$

Going Concern Technical Deficiency

$\$17,800,000 - \$15,600,000 = \$2,200,000$ Surplus - no GC Special Payment

Going Concern Stabilization Deficiency

SP % applied to Deficiency = $15.6\% - 5.0\% = 10.6\%$

$\$15,600,000 * (1 + 10.6\%) = \$17,253,600$

$\$17,800,000 - \$17,253,600 = \$546,400$ Surplus - no GC Stabilization Deficiency payment

Total minimum contributions for 2017

= Total Normal Cost + GC Technical Deficiency Amortization + GC Stabilization Deficiency Amortization

= $\$94,792 + \$0 + \$0$

= $\$94,792$

Employer can't use the GC Stabilization Surplus of \$546,400 to offset the Total Normal Cost as conditions to use surplus are not met:

- the assets < 105% of the going concern liabilities plus SP, and
- the solvency ratio < 105%.

No solvency special payments are required.

- (b) Calculate the minimum contributions required for 2017.

Show all work.

Commentary on Question:

Overall, candidates performed very well on this part of the question.

Going concern financial position:

Market Value of Assets	\$17,800,000
Going concern liabilities	\$17,940,000
Going concern excess (deficiency)	(\$140,000)

9. Continued

Going concern annual special payment:

Deficiency is \$140,000 , amortized over 15 years

Annual special payments are $\$140,000 / 10.4 = \$13,462$

Present value of next 5 years of going concern special payments:

$\$13,462 * 4.7 = \$63,271$

Solvency financial position

Market Value of Assets	\$17,800,000
Wind-Up Expenses	(\$200,000)
Present value of next 5 years of going concern special payments	\$63,271
Adjusted Solvency Assets	\$17,663,271
Solvency Liabilities	\$18,500,000
Total Liabilities	\$18,500,000
Solvency Surplus (Deficiency)	(\$836,729)

Solvency special payment

$\$836,729 / 4.7 = \$178,027$

Total minimum contributions:

=Total Normal Cost + GC Deficiency Amortization + Solvency Deficiency Amortization

= $\$97,000 + \$13,462 + \$178,027 = \$288,489$

10. Learning Objectives:

4. The candidate will understand the principles and rationale behind regulation.

Learning Outcomes:

- (4a) Describe the principles and motivations behind pension legislation and regulation.

Sources:

FR-120-14: IOPS Principles of Private Pension Supervision

Commentary on Question:

In general, candidates performed poorly on this question. The question was based on the reading FR-120-14 IOPS Principles of Private Pension Supervision and the objective was to test a candidate's ability to view pension supervision from the perspective of a regulator (i.e., a pension supervisory authority). In general, candidates answered from the perspective of plan sponsors or plan members without reference to the reading. Furthermore, candidates were not able to identify key points under the sections that were asked.

Solution:

Describe the actions that would need to be taken for a pension supervisory authority to conform to the following principles as described in the “IOPS Principles of Private Pension Supervision”:

- (i) Governance;
- (ii) Risk-based supervision; and
- (iii) Transparency.

Describe the actions that would need to be taken for a pension supervisory authority to conform to the following principles as described in the “IOPS Principles of Private Pension Supervision”:

- (i) Governance;

The supervisory authority should adhere to its own good governance practices including:

0. governance codes,
1. internal risk management systems, and
2. performance measurement.

10. Continued

The supervisory should be accountable. Actions the supervisory authority can take to conform to the governance principle are the following:

1. Establish and operate sound governance practices to maintain credibility and moral authority.
2. Be overseen by a governing board of a manageable size.
3. Establish and adhere to a governance code, outlining suitable internal controls, checks and balances, and effective process for risk and performance management
4. Establish an internal audit process.
5. Be subject to external audit by a state or independent audit institution.
6. Have procedures in place to appeal the pension supervisory authority decisions.
7. Monitor their own performance.

(ii) Risk-based supervision :

The supervisory authority should adopt a risk-based approach. Actions the supervisory authority can take to conform to the risk-based supervision principle are the following:

1. Establish a risk-based approach and a suitable risk-assessment methodology to use resources efficiently.
2. Move towards risk-based approach and the move can be phased in gradually and used with traditional rules-based supervision.
3. Set up a legal framework allowing suitable discretion in terms of interpretation and exercise of supervisory powers is required.
4. Communicate its risk-based approach to the pension industry explaining what is expected.
5. When quantitative risk assessment tools are used, the models involved should be carefully designed and their limitations fully understood by the pension supervisory authorities.
6. Risk-scoring models should reflect the risk-focus of the pension supervisory authority and the net risk of relevant individual entity and systemic risk factors.

10. Continued

(iii) Transparency:

The supervisory authority should conduct their operations in a transparent manner. Actions the supervisory authority can take to confirm to transparency principle are the following:

1. Adopt a clear, transparent and consistent supervisory process. The rules and procedures should be published to the pension industry.
2. Operate in a transparent environment and should publish reports regularly on...
 - Conduct of its policy;
 - Explaining its objectives; and
 - Describing its performance in pursuing those objectives
3. Broad outlines of any supervisory response framework should be made public by supervisory authority so its actions are well understood by supervised entities.
4. Be subject to regular audit and reporting requirements.
5. A transparent information disclosure mechanism and timely publication of intervention and sanction decisions where appropriate should be in place.
6. Provide and publish clear and accurate information for the pension industry and the general public on a regular basis.

11. Learning Objectives:

2. The candidate will understand how to analyze/synthesize the factors that go into selection of actuarial assumptions for funding purposes.

Learning Outcomes:

- (2a) Describe and apply the techniques used in the development of economic assumptions for funding purposes.

Sources:

CIA Educational Note: Assumptions for Hypothetical Wind-Up and Solvency Valuations with Effective Dates Between December 31, 2016 and December 30, 2017

Commentary on Question:

The purpose of this question was to test candidate's knowledge of determining the appropriate discount rate for estimating the cost of purchasing non-indexed, fully indexed, and partially indexed annuities.

Solution:

- (a) Calculate the appropriate discount rate used to determine the liabilities assumed to be settled through the purchase of annuities for the hypothetical wind-up valuation as at December 31, 2016 for each of the following:
 - (i) Plan A
 - (ii) Plan B
 - (iii) Plan C

Show all work.

Commentary on Question:

Candidates generally performed well on this question.

On part ii), credit was awarded to candidates who suggest adjusting the spread down to allow for the decrease in underlying yields that would be seen at lower durations (i.e. CANSIM V39062 reflects all bonds with maturities over 10 years, which may not be an appropriate benchmark for this group). This assumption would be more conservative in the absence of true market pricing.

Rounding up to 10bps was acceptable for full credit for each of i), ii) and iii).

11. Continued

(i) **Plan A**

Candidate interpolates correctly to determine the applicable spread:

$$\{(9.1 - 8.5) * (0.90\%) + (11.0 - 9.1) * (0.70\%)\} / (11.0 - 8.5) = 0.75\%$$

Candidate must combine the information to provide the final answer:

$$\text{CANSIM V39062} + \text{spread: } 2.21\% + 0.75\% = 2.96\%$$

(ii) **Plan B**

One reasonable approach would be to assume that the spread for durations lower than 8.5 is + 70bps, which would give an annuity purchase rate of:

$$2.91\% (2.21\% + 0.70\% = 2.91\%).$$

It is rare that a group would have a duration materially lower than 8.5, so there is little market data to indicate how insurers would price this group.

(iii) **Plan C**

The non-indexed proxy for this group is 3.198% (2.21% + 0.988%) and the indexed proxy for this group is -0.09% (0.51% - 0.60%).

$$\{(13.2 - 11.0) * (1.00\%) + (13.5 - 13.2) * (0.90\%)\} / (13.5 - 11.0) = 0.988\%$$

$$\text{CANSIM V39062} + \text{spread: } 2.21\% + 0.988\% = 3.198\%$$

$$\text{CANSIM V39057} + \text{spread: } 0.51\% - 0.60\% = -0.09\%$$

$$80\% * (-0.09\%) + (1 - 80\%) * (3.198\%) = 0.568\%, \text{ which reflects indexation of 80\% of CPI.}$$

- (b) Explain, in words, how you would determine an appropriate annuity purchase discount rate for Plan D.

Commentary on Question:

Overall, candidates did not perform well on this part of the question.

Some candidates received partial credit because they correctly described the method to determine the annuity purchase discount rate for partially indexed plans without caps, floors, and offsets. This method is consistent with the calculation for part a iii).

Very few candidates acknowledged that stochastic modelling can be used to determine an appropriate adjustment to the partially indexed discount rate to account for caps, floors and offsets.

11. Continued

Plan D has partially indexed annuities with a cap, a floor, and an offset.

The discount rate for partially indexed annuities can be broken down into two components:

- 1) Best estimate indexing produced by the formula
- 2) Risk premium

In this case, the best estimate of inflation is 1.70% ($= 2.21\% - 0.51\%$)

The inflation risk premium is determined as the difference between (1) and (2), where (1) is the difference between the discount rate used to determine non-indexed annuities less the discount rate used to determine the cost of fully indexed annuities and (2) is the best estimate indexing.

Before considering the impact of the cap, offset, and floor, the applicable discount rate would be determined using the same approach as for plan C in a).

You would adjust the implicit discount rates otherwise applicable, based on the likelihood of the cap, offset, and floor causing a material change in pension payable in any future year, guided by the current economic environment, economic expectations, and long-term historical experience. You may use stochastic analysis for this purpose.

12. Learning Objectives:

1. The candidate will understand how to analyze data for quality and appropriateness.
7. The candidate will understand how to apply the standards of practice and professional conduct guidelines.

Learning Outcomes:

- (1a) Identify data needed.
- (1b) Assess data quality.
- (1c) Make and/or recommend appropriate assumptions where data cannot be provided.
- (1d) Comply with regulatory and professional standards pertaining to data quality.
- (7b) Explain and apply the Professional Conduct Guidelines.
- (7c) Explain and apply relevant qualification standards.
- (7d) Demonstrate compliance with requirements regarding the actuary's responsibilities to the participants, plans sponsors, etc.
- (7f) Recognize situations and actions that violate or compromise Standards or Professional Conduct Guidelines.
- (7g) Recommend a course of action to repair a violation of the Standards or Professional Conduct Guidelines.

Sources:

ASOP 23 Data Quality
CIA Consolidated Standards of Practice – Sections 1530 and 1600
CIA Rules of Professional Conduct
SOA Code of Professional Conduct
CIA Guidance Document: General Advice on the Application of Rule 13

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) List the membership data you will need to perform the valuation as at January 1, 2017.

Commentary on Question:

Candidates generally did well; however most did not consider province of terminated members.

12. Continued

Active members

- gender
- province of employment
- date of birth or age
- date of entry or credited service
- earnings history
- salary rate for 2017
- full or part-time status

Deferred vested participants

- gender
- province
- date of birth
- date of termination
- accrued pension
- voluntary or involuntary termination
- grow-in eligibility
- unreduced retirement date (could be 62 for grow-in eligible members)

Members terminated in 2016

- list of members who terminated in 2016
- dates of termination
- commuted value amounts, if applicable
- commuted value payment date, if applicable

Retired members and Beneficiaries in pay

- status (member in pay or beneficiary in pay)
- gender
- province
- date of birth
- date of retirement
- pension amount
- form of pension
- spouse's date of birth, if member has a joint and survivor form of pension

- (b) Describe the appropriate course of action taking into consideration the rules of professional conduct.

12. Continued

- A member who becomes aware of an apparent material noncompliance with the Rules or the standards of practice by another member shall attempt to discuss the situation with the other member and resolve the apparent noncompliance.
- If the member admits to the non-compliance and rectifies the problem, in which instance the affected work must be corrected, users of the work must be notified, and the consequences of that notification must be resolved, nothing further needs to be done. *[Guidance Document on Rule 13]*
- If the member in apparent noncompliance did not agree to a discussion or the discussion did not result in an agreement as to whether a noncompliance has taken place; or there was agreement that noncompliance has taken place, but no corrective action was taken as a result, the member is obliged to report the noncompliance to the Committee on Professional Conduct. *[Guidance Document on Rule 13]*

However, a member is not required to report to the CPC where such reporting would be contrary to law or, when the member is acting in an adversarial environment, for the duration of such adversarial environment.

- (c) Explain how you would apply the standards of practice regarding the sufficiency and reliability of the data as a guidance to proceed with the valuation as at January 1, 2017.

1) (Data cannot be perfect)

Data that are completely accurate, appropriate, and comprehensive are frequently not available

- If the ideal data are unobtainable at reasonable cost within the available time, consider what, if any, alternative data are sufficient and reliable.

2) (Adjust defective data and disclose assumptions).

- Judgmental adjustments or assumptions can be applied

- Should arrange for a more extensive review

- If defective data causes the results to be highly uncertain, disclose uncertainty or bias / reports usual opinion with reservation which describes the defect, describes the work done and assumptions made to cope with the defect

- If reasonably determinable, nature and potential magnitude of uncertainty or bias / if practical, quantifies the effect of the defect on the result

12. Continued

3) (*What to do when data is inadequate*).

- explain that an opinion is not given because it is not possible to estimate the effect of the defect on the result.
- decline to complete the assignment.