1. **Learning Objectives:**
   1. The candidate will understand how to analyze data for quality and appropriateness.
   2. The candidate will understand how to analyze/synthesize the factors that go into selection of actuarial assumptions for funding purposes.

**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.
(2b) Evaluate and recommend appropriate assumptions for funding purposes.
(2c) Evaluate actual experience, including comparisons to assumptions.

**Sources:**
Experience Data Quality: How to Clean and Validate Your Data, Society of Actuaries (excluding introduction)
ASOP 25: Credibility Procedures
ASOP 35: Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations

**Commentary on Question:**
The objective of this question is to test the candidate’s understanding of how to select the termination assumption for a going concern valuation, including considerations for performing an experience study.

**Solution:**
(a) Describe the considerations in setting the termination assumption.

**Commentary on Question:**
Candidate should describe each consideration listed
1. Continued

The actuary should consider factors such as the following:
1. job-related factors such as occupation, work environment, unionization, hazardous conditions, and location of employment; and
2. plan provisions, such as early retirement benefits, vesting schedule, or payout options.

The actuary should also consider:
1. Materiality
   - The accuracy of the assumption is less important if the assumption does not materially affect the liabilities
2. Cost Effectiveness
   - Although all material demographic assumptions should be reflected, the actuary can strike a balance between refined methodology and cost effectiveness
3. Combined Effect of Assumptions
   - The combined effect of all non-prescribed assumptions (both demographic and economic) should be reasonable.
   - For example, omitting a single assumption may be immaterial, but omitting several assumptions that are individually immaterial may not be appropriate.
4. Knowledge Base
   - The demographic assumptions selected should reflect the actuary’s knowledge as of the measurement date.
   - However, events after the measurement date may affect the actuary’s assumptions. If appropriate, the actuary may reflect subsequent events as of the measurement date.
1. Continued

5. Advice of Experts
   - *Demographic data and analyses are available from a variety of sources, including the plan sponsor and administrator, demographers, economists, accountants, and other professionals.*
   - *External expert advice may be considered when selecting demographic assumptions, but the selection should still reflect the actuary’s professional judgment.*

(b) Describe the considerations in collecting data for a termination experience study.
   1. Determine what data to use,
      - taking into account the scope of the assignment, and
      - the intended use of the analysis being performed.
   2. Consider relevance of the data.
   3. Consider source of the data.
   4. Determine whether data provided by others can be relied upon.
   5. Determine whether termination data is complete/sufficient.
      - Use professional judgment if complete data is not available to determine if available data will allow the actuary to perform the desired analysis.
      - If significant data limitations are known to the actuary, the actuary should disclose those limitations and their implications.
      - Consider the data elements that are desired and possible alternative data elements.
   6. Determine whether termination data is accurate.
      - Review, validate and, if necessary, cleanse data.
      - Check for data accuracy errors including experience period error and/or missing value error
      - Confirm data validation through consistency, homogeneity and/or reasonability (unexpected spikes, changes in trends)
   7. Determine the credibility of the experience study.
      - Evaluate the experience for potential use in setting assumptions without reference to other data.
      - Consider the characteristics of both current and previous experience periods.
      - Determine the level at which the subject experience is assigned full, partial or zero credibility, often based on a selected confidence interval or sometimes using a rigorous mathematical model.
2. Learning Objectives:
5. The candidate will understand how to evaluate and apply regulatory policies and restrictions for registered retirement plans.

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

Learning Outcomes:
(i) The candidate will be able to describe and apply regulation pertaining to contributions and benefits.

Sources:
FR-114-19: Ontario Pension Benefits Act R.R.O. 1990, Reg 909 (excluding sections 5.5.1 and 5.5.2 - Funding and Funding Relief for Specified Pension Plans and 5.5.3, 5.6, 5.6.1, 5.6.2, 5.7, 5.8, 5.9, 5.10 - Solvency Funding Relief))


FR-117-15: FSCO overview and Q&A on Letters of Credit

FR-118-15: FSCO overview and Q&A on Letters of Credit – FAQs

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-140-18: Quebec: Final Regulation on the Stabilization Provision for Private Sector Pension Plans

Commentary on Question:
The question required candidates to compare and contrast the minimum funding regulations. Many candidates did not do this, and instead only listed the characteristics. Also, many candidates listed funding regulations for plan improvements and COLAs when the question states that these do not apply. Lastly, many candidates did not mention letter of credit rules, transfer deficiency rules, and contribution holiday rules.

Solution:
Compare and contrast the minimum funding regulations applicable to both plans for valuations as at January 1, 2019. Assume that contributions under the Ontario funding regulations are lower based on the current regulations than the previous regulations.
2. Continued

- Going concern – future service
  - Ontario and Quebec rules are similar
  - Ontario: the contribution requirements are the sum of the normal cost, i.e. the cost of pension benefits for one year determined on a going concern basis, and the provision for adverse deviations in respect of the normal cost.
  - Quebec: similar to Ontario except that the provision for adverse deviations is named a stabilization provision.
  - The provision for adverse deviations and stabilization provision are based on the asset allocation and how risky the assets are invested.
  - Both provisions factor allocation to non-fixed-income assets, but only Quebec reflects asset/liability duration mismatch.
  - For the same asset allocations, the values of the PfAD or stabilization provisions differ for each province.

- Going concern – past service
  - Ontario: if the plan has a going concern unfunded liability, i.e. if the sum of the going concern liabilities and the provision for adverse deviations in respect of the going concern liabilities exceeds the going concern assets, the contribution requirements are the sum of:
    - for the first year following the valuation date, the special payments required to liquidate the going concern unfunded liability scheduled for that year as determined in the prior valuation report;
    - for the following years, the special payments required to liquidate the going concern unfunded liability at the valuation date, with interest, by equal monthly payments over a period of 10 years beginning one year after the valuation date.
  - Quebec: similar to Ontario in that it must also fund going concern deficiencies. The differences in funding are that the plan sponsor is required to fund up to the stabilization provision minus 5% and there is no 1-year lag.

- Solvency
  - Ontario and Quebec rules are different.
  - Ontario: if the plan has a reduced solvency deficiency, i.e. if the sum of 85% of the solvency liabilities, 85% of the solvency liability adjustment and the prior year credit balance, exceeds the sum of the solvency assets and the solvency asset adjustment, the contribution requirements are the special payments required to liquidate the reduced solvency deficiency at the valuation date, with interest, by equal monthly payments over a period of 5 years beginning one year after the valuation date.
  - Quebec: no solvency funding.
2. Continued

- Letter of credit
  - Ontario: Employers can use a letter of credit issued by a financial institution, which meets certain prescribed requirements, and amounting up to 15% of the solvency liabilities of the plan.
  - Quebec: similar to Ontario employers can use a letter of credit and up to 15% of the funding liability, but it is allowed for the stabilization amortization payments only.

- Transfer deficiency
  - Ontario and Quebec rules are different.
  - Ontario: transfer deficiency contributions are the amount of a commuted value that is transferred out of the plan multiplied by the minimum of the most recently determined transfer ratio and 1. If the transfer ratio of the plan is less than 100%, the portion of a commuted value of pension benefits that can be transferred out of the plan is determined by multiplying the commuted value by the most recently determined transfer ratio, or all the commuted value may be transferred out if the transfer deficiency contributions are remitted to the pension fund or if the aggregate transfer deficiencies for all transfers made since the last valuation does not exceed 5% of the plan’s assets at that time. If less than 100% of the commuted value is transferred, the balance has to be transferred within 5 years of the initial transfer with interest.
  - Quebec: transfer deficiency funding still applies without Solvency funding.

- Contribution holiday
  - Ontario and Quebec rules are similar.
  - Ontario: Available actuarial surplus is equal to zero if special payments are required to be made. If no special payments are required to be made, then the available actuarial surplus is equal to the lesser of the going concern excess and the amount that, if deducted from the plan’s solvency assets, would reduce the transfer ratio to 105%.
  - Available actuarial surplus can be applied to reduce the minimum required contributions.
  - At the beginning of each plan year, an actuarial cost certificate must be filed within the first 90 days of the year showing the estimate available actuarial surplus.
  - Quebec: similar to Ontario, the plan must reach a solvency ratio of 105%. One difference is that the funding level must be at least 105% plus the stabilization provision.
2. Continued

- Frequency of valuation
  - Ontario and Quebec rules are similar.
  - Ontario: annual valuations are required if there are solvency concerns (i.e. if the ratio of the solvency assets to the solvency liabilities is less than 85%). Otherwise, a valuation is required every three years.
  - Quebec: similar to Ontario, annual valuations are required if the solvency level is less than 85% and, otherwise, a valuation is required every three years. One difference is that an annual test of estimated solvency level is required.
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.

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

(3d) Analyze and communicate the impact on cost stability of a variety of asset valuation methods.

**Sources:**

**Commentary on Question:**
*For this question, candidates were tested on how to value employer normal cost and the actuarial liability under the aggregate actuarial cost method and to compare and contrast the normal cost pattern under the aggregate and the projected unit credit funding methods.*
*Candidates generally did better in part (a), the calculations, than part (b) where they were asked to compare and contrast the normal cost pattern under two different funding methods.*

**Solution:**
(a) Calculate the employer normal cost and the actuarial liability as at January 1, 2019.

Show all work.

**Commentary on Question:**
*Candidates would receive full points on this part if they show the calculations of each of the components required to calculate the normal cost (i.e., $NC^{Emp}_{2019} = (PVFB_{2019} - F_{2019} - PVEEC) / PVFS \times S_{2019}$)*

**Calculation of $AL_{2019}$**
Because UAL is always equal to $0$ under Aggregate method, $AL = MVA$
Hence, $AL_{2019} = $275,000
3. Continued

**Calculation of NC\textsubscript{2019}**

Determining the Present Value of Future Benefits

**Calculations for Employee A**

- **x** = current age = 60
- **y** = normal retirement date = 65
- **c** = credited service = 20

\[
\text{PVFB}_\text{A}\text{RetBen} = 0.015 \times \text{Salary} \times (1+ss)^{y-x-1} \times (y-x+c) \times (1-qt)^{60-x} \times (1+i)^{(y-x)} \times \bar{a}_{65}^{(12)}
\]

\[
= 0.015 \times 70,000 \times 1.025^4 \times 25 \times 0.970 \times 1.05^{-5} \times 13.4
\]

\[
= \$304,217
\]

\[
\text{PVFB}_\text{A}\text{TermBen} = \$0 \quad \text{No more decrement once reached 60}
\]

So, the present value of future benefits for employee A is:

\[
\text{PVFB}_\text{A} = \text{PVFB}_\text{A}\text{RetBen} + \text{PVFB}_\text{A}\text{TermBen} = \$304,217 + \$0 = \$304,217
\]

**Calculations for Employee B**

- **x** = current age = 56
- **y** = normal retirement date = 65
- **c** = credited service = 17

\[
\text{PVFB}_\text{B}\text{RetBen} = 0.015 \times \text{Salary} \times (1+ss)^{y-x-1} \times (y-x+c) \times (1-qt)^{60-x} \times (1+i)^{(y-x)} \times \bar{a}_{65}^{(12)}
\]

\[
= 0.015 \times 64,000 \times 1.025^8 \times 26 \times 0.97^4 \times 1.05^{-9} \times 13.4 = \$232,554
\]

\[
\text{PVFB}_\text{B}\text{TermBen} = z \times \text{AccCon}_{x+1}/(1+i) + (1-z)*z \times \text{AccCon}_{x+2}/(1+i)^2 + (1-z)^2*z \times \text{AccCon}_{x+3}/(1+i)^3 + (1-z)^3*z \times \text{AccCon}_{x+4}/(1+i)^4
\]

where \( z \) = termination scale = 0.03

\[
\text{AccCon}_{x+1} = (1+ic) \times (\text{AccCon}_x + 0.04 \times \text{SAL}_x \times (1+ss)^{x-c})
\]

\[
\text{AccCon}_{57} = (1.02) \times (\$41,000 + \$64,000 \times 0.04) = \$44,431
\]

\[
\text{AccCon}_{58} = (1.02) \times (\$44,431 + \$64,000 \times 0.04 \times (1.025)) = \$47,996
\]

\[
\text{AccCon}_{59} = (1.02) \times (\$47,996 + \$64,000 \times 0.04 \times (1.025)^2) = \$51,700
\]
3. Continued

\[ \text{AccCon}_0 = (1.02) \times ($51,700 + $64,000 \times 0.04 \times (1.025)^3) = $55,546 \]

\[ \text{PVFB}_B \text{TermBen} = 0.03 \times 44,431/1.05 + 0.97 \times 0.03 \times 47,996/1.05^2 + 0.97^2 \times 0.03 \times 51,700/1.05^3 + 0.97^3 \times 0.03 \times 55,546/1.05^4 = $5,047 \]

So, the present value of future benefits for employee B is:

\[ \text{PVFB}_B = \text{PVFB}_B \text{RetBen} + \text{PVFB}_B \text{TermBen} = $232,554 + $5,047 = $237,601 \]

Total Present value of future benefits for the plan:

\[ \text{PVFB} = \text{PVFB}_A + \text{PVFB}_B = $304,217 + $237,601 = $541,818 \]

Calculate the Present Value of Future Salary

Let \( j = (1+i)/(1+ss) = 1.05/1.025-1 = 2.44\% \)

Let \( k = (1-qt) \times (1+ss)/(1+i) = 0.97 \times 1.025/1.05 = 0.9469 \)

\[ \text{PVFS}_A = \$70,000 \bar{a}_{5|j} = \$70,000 \times 4.77 = \$333,900 \]

\[ \text{PVFS}_B = \$64,000 \left[ 1 + (0.97 \times 1.025/1.05) + (0.97^2 \times 1.025^2/1.05^2) + (0.97^3 \times 1.025^3/1.05^3) + (0.97^4 \times 1.025^4/1.05^4) \times \bar{a}_{5|j} \right] = \$64,000 \left[ 1 + k + k^2 + k^3 + k^4 \times \bar{a}_{5|j} \right] = \$481,751 \]

\[ \text{PVFS} = \text{PVFS}_A + \text{PVFS}_B = \$333,900 + \$481,751 = \$815,651 \]

Present value of employee contributions

\[ \text{PVEEC} = 4\% \times \text{PVFS} = 4\% \times \$815,651 = \$32,626 \]

Normal Cost

\[ \text{NC}_{\text{Emp}}^{2019} = (\text{PVFB}_{2019} - F_{2019} - \text{PVEEC})/\text{PVFS} \times S_{2019} \]

\[ = (\$541,818 - \$275,000 - \$32,626)/\$815,651 \times (\$70,000 + \$64,000) = \$38,474 \]
3. Continued

(b) Compare and contrast the pattern of development over time of the normal cost under the Aggregate and Projected Unit Credit funding methods. No calculations are required.

Commentary on Question:
Candidates were required to compare and contrast the cost patterns, not the advantages or their preferred uses of each funding method. Candidates were not required to list everything below to receive full points to this part of the question. The list below provides additional items for the candidates to elaborate on the cost patterns of both methods.

Under Aggregate Method
AL = MVA (market value of assets) since UAL = 0
NC = \((PVFB - F - PVEEC) / PVFS \times S\)

- No Accrued Liability calculation - UAL always equals zero - Accrued Liability always equals plan assets
- All deviations from experience, and even liabilities attributable prior to the plan inception, are funded over future Normal Costs
- Both the AL and NC don’t have definite pattern. Highly dependent on value of assets so will vary heavily in time.

Under Projected Unit Credit Method (PUC)
\(AL_x = B(x) r-x p_x v r-x \bar{a}_r^{(12)}\)
\(NC_x = \Delta B r-x p_x v r-x \bar{a}_r^{(12)}\) where \(B(x) = B(r) f(x)\) and \(\Delta B = B(r) \Delta f\)

- Relates cost to benefit accruals - Normal cost (NC) under PUC increases with age of the member
- Accrued benefit calculated by projecting the retirement benefit using salary scales and then redistributing the benefit over an employee’s career to produce a hypothetical pattern of accruals that may or may not be related to the actual accrual pattern described by the plan
- Rising pattern of PUC normal costs over a member’s career means that the fixed contribution rate cannot cover the member’s NC.
4. **Learning Objectives:**

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

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

**Learning Outcomes:**

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

**Sources:**

**Commentary on Question:**

*Overall question was well done, in particular part (a). Some candidates struggled with part (b).*

**Solution:**

(a) Determine the minimum required and maximum permissible contributions for 2019.

Show all work.

**Commentary on Question:**

*Part A was generally done quite well. Some candidates lost points for calculating the Stabilization Provision incorrectly, but still received most points as the contribution calculations were done well.*

Calculate Stabilization Provision

Duration of assets: 19.35M/43.0M* 7 years = duration of 3.15 years
Asset duration/liability duration = 3.15 years / 12 years = 26.25%

The variable income securities = 23.65/43.0 = 55%, so the stabilization provision is between 14% and 16%
The stabilization provision = 16% - (26.25-25)/(50-25)*(16%-14%)=15.9%.

Apply SP to NC

Normal cost to fund is: $1.25M * 1.159 = $1,448,750

Calculate payments using appropriate amortization and going-concern position
4. Continued

Funding target = (1+ 15.9% - 5%) * going concern liability = $47,132,500
Deficit = funding target – assets = $4,132,500

Deficit to be amortized over 12 years @ 5.50%

Annual amount payable monthly = $4,132,500/8.87 = $465,896

Determine minimum contribution requirements

$1,448,750 + $465,896 = $1,914,646

Determine maximum contribution requirements

NC (with PfAD) + max(solvency deficit, gc deficit)

$1,448,750 + $4,000,000 = $5,448,750

(b) Calculate the estimated minimum required contributions for 2020 by extrapolating the liabilities and reflecting the sensitivity of liabilities and normal cost to interest rates.

Show all work.

Commentary on Question:
Candidates did not do as well on part (b), despite the concept being similar to part (a). Some candidates failed to re-determine the SP. Candidates also seemed to struggle in accurately estimating the duration adjusted liability and normal cost.

Acknowledge no solvency special payments.

Roll-forward the liabilities to December 31 2019, excluding pensioner liabilities
($17.5M + $1.25M)*(1+5.50%) = $19,781,250

Duration adjustment on AL
(的各种 methodology is accepted as long as supported by core principles)
(5.50% - 6.00%) * 19 duration = -9.50%
(1 – 9.50%) * $19,781,250 = $17,902,031

Calculate Stabilization Provision

Duration of assets: $2.25M/$19.75M* 7 years = duration of 0.80 years
Asset duration/liability duration = 0.80 years / 19 years = 4.21%
4. Continued

The variable income securities = $17.5M/$19.75M = 88.6%, so the stabilization provision is between 23.29% and 25.29%

The stabilization provision = 25.29% - (4.21-0)/(25-0)*(25.29%-23.29%)
=25.29% - 0.34% = 24.95% = 25.0% after rounding.

Apply SP to rolled-forward and duration adjusted NC (do not penalize if Duration adjustments to NC used another acceptable method)

(5.50% - 6.00%) * 25 duration = -12.50%
(1 – 12.50%) * $1,250,000 * 1.055 = $1,153,906
Normal cost to fund is: $1,153,906 * 1.25 = $1,442,383

Funding target = (1+ 25% - 5%) * going concern liability = 21,482,437

Deficit = funding target – assets = $21,482,437 – $19,750,000 = $1,732,437
Deficit to be amortized over 11 years @ 6.00%.
Annual amount payable monthly = 1,732,437/8.141 = 212,804
Determine minimum contribution requirements = $1,442,383+ $212,804= $1,655,187
5. **Learning Objectives:**

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

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

**Learning Outcomes:**

(3f) Calculate actuarially equivalent benefits.

(5h) The candidate will be able to describe and apply regulation pertaining to members’ rights.

(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:**


FR-133-17: Actuarial Equivalence Calculations

**Commentary on Question:**

*Commentary listed underneath question component.*

**Solution:**

(a) Calculate the lifetime and bridge pensions payable from the DPC plan as at July 1, 2019 under the normal form.

Show all work.

**Commentary on Question:**

*Most candidates were able to determine the maximum lifetime pension payable. The bridge maximum and combined maximums were also done well by most candidates with most candidates losing marks for not applying the ITA maximum bridge factors properly.*
5. Continued

<table>
<thead>
<tr>
<th><strong>Lifetime Pension Calculations:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Accrued Benefit (uncapped &amp; unreduced)</td>
<td>1.5% * 220,000 * 7 = $23,100</td>
</tr>
<tr>
<td>Minimum Requirement Actuarial Equivalence</td>
<td>1 - 10.86/18.08 = 39.93%</td>
</tr>
<tr>
<td>Plan Reduction</td>
<td>MAX(0, 62-58) * 0.25% * 12 = 12%</td>
</tr>
<tr>
<td>Test if plan reduction is better than actuarial equivalence</td>
<td>MIN(12%, 39.93%) = 12%</td>
</tr>
<tr>
<td>Reduced Lifetime Pension Uncapped</td>
<td>$23,100 * (1 - 12%) = $20,328</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ITA Maximum Pension Calculations:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) ITA Maximum Benefit (unreduced)</td>
<td>$3,026 * 7 = $21,182</td>
</tr>
<tr>
<td>(ii) ITA HAE3 Formula</td>
<td>2% * 240,000 * 7 = $33,600</td>
</tr>
<tr>
<td>ITA Max Lifetime Pension - (Min of I &amp; ii)</td>
<td>MIN($21,182, $33,600) = $21,182</td>
</tr>
<tr>
<td>Earliest Unreduced ITA Date</td>
<td>01/07/2021 (Service of 30 years or 80 points or age 60 eligibility rule applied)</td>
</tr>
<tr>
<td>ITA reduction</td>
<td>MAX(0, 60-58) * 0.25% * 12 = 6%</td>
</tr>
<tr>
<td>Reduced ITA maximum pension</td>
<td>$21,182 * (1 - 6%) = $19,911</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Maximum Lifetime Pension Payable at Early Ret.</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>= $19,911</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Bridge Pension Calculations:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan Bridge Benefit</td>
<td>20 * 12 * 7 = 1,680</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ITA Maximum Bridge</strong></th>
<th>Member does not have 10 years service and has not attained age 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unreduced maximum Bridge</td>
<td>OAS + CPP for month of commencement = 12 * (1155 + 607) = $21,144</td>
</tr>
<tr>
<td>Bridge Reduction</td>
<td>Prorate for &lt; 10 years svc &amp; reduced 0.25% per month before age 60 = MIN(1.7/10) * (1 - (60 - 58) * 0.25% * 12) = 0.658</td>
</tr>
<tr>
<td>Reduced Maximum Bridge</td>
<td>$21,144 * 0.658 = $13,913</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ITA Combined Limit</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Limit</td>
<td>No Early Retirement Reductions = 3,026 * 7 + 25% * 56,200 * 7/35 = $23,922</td>
</tr>
<tr>
<td>Combined Pension</td>
<td>$20,328 + 1,680 = $22,008</td>
</tr>
<tr>
<td>Maximum pension payable (total)</td>
<td>$22,008 Under the combined limit</td>
</tr>
<tr>
<td>Maximum bridge payable</td>
<td>$23,922 - 19,911 = 4,011 Not capped</td>
</tr>
</tbody>
</table>
### Lifetime Pension Calculations:

When an accrued benefit is increased by an actuarial equivalence, the plan reduction is applied to the reduced lifetime pension.

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accrued Benefit (uncapped &amp; unreduced)</td>
<td>$1.5% \times 220,000 \times 7$</td>
<td>$23,100$</td>
</tr>
<tr>
<td>Minimum Requirement Actuarial Equivalence</td>
<td>$1 - \frac{10.86}{18.08}$</td>
<td>$39.93%$</td>
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<td>$12%$</td>
</tr>
<tr>
<td>Reduced Lifetime Pension Uncapped</td>
<td>$23,100 \times (1 - 12%)$</td>
<td>$20,328$</td>
</tr>
</tbody>
</table>

### ITA Maximum Pension Calculations:

The ITA maximum pension is calculated using the ITA Maximum Benefit and the ITA HAE3 Formula.

<table>
<thead>
<tr>
<th>Description</th>
<th>Formula</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) ITA Maximum Benefit (unreduced)</td>
<td>$3,026 \times 7$</td>
<td>$21,182$</td>
</tr>
<tr>
<td>(ii) ITA HAE3 Formula</td>
<td>$2% \times 240,000 \times 7$</td>
<td>$33,600$</td>
</tr>
<tr>
<td>ITA Max Lifetime Pension - (Min of I &amp; ii)</td>
<td>$\text{MIN}(21,182, 33,600)$</td>
<td>$21,182$</td>
</tr>
</tbody>
</table>

**Earliest Unreduced ITA Date:**

01/07/2021 (Service of 30 years or 80 points or age 60 eligibility rule applied)

**ITA reduction:**

$\text{MAX}(0, 60 - 58) \times 0.25\% \times 12 = 6\%$

**Reduced ITA maximum pension:**

$21,182 \times (1 - 6\%) = 19,911$

**Maximum Lifetime Pension Payable at Early Ret.:**

$19,911$

**Actual bridge payable:**

$1,680$

Payable until earlier of age 65 and death. No indexation

---

**Commentary on Question:**

Candidates were able to apply the correct conversion factors. However, many candidates incorrectly applied the conversion to the ITA maximum pension instead of the uncapped lifetime plan pension.

---

(b) Calculate the lifetime pension payable under the following optional forms of payment:

(i) Life only

(ii) Life guaranteed for 10 years

(iii) Life guaranteed for 15 years

Show all work.
5. Continued

| Reduced Lifetime Pension Uncapped from part A | $20,328 |
| (i) Conversion to Life Only | |
| Conversion Factor | =18.08/18.01 = 1.0039 |
| Reduced Life Only Pension Uncapped | =20328*1.0039 = 20,407.28 |
| Reduced ITA maximum pension from A | = 19,911 |
| Maximum Lifetime Pension Payable at Early Retirement | = $19,911 in life only |

(ii) Conversion to Life 10

| Conversion Factor | =18.08/18.27 = 0.9896 |
| Reduced Life Only Pension Uncapped | =20328*0.9896 = 20,116.59 |
| Reduced ITA maximum pension from A | = 19,911 |
| Maximum Lifetime Pension Payable at Early Retirement | = $19,911 in life 10 |

(iii) Conversion to Life 15

| Conversion Factor | =18.08/18.58 = 0.9731 |
| Reduced Life Only Pension Uncapped | =20328*0.9731 = 19,781.18 |
| Reduced ITA maximum pension from A | = 19,911 |
| Maximum Lifetime Pension Payable at Early Retirement | = $19,781 in life 15 |

(c) Describe the limitations placed under the Income Tax Act on the amount of the lump sum transfer of the commuted value from the DPC plan.

Commentary on Question:
Candidates generally did well on this part of the question.

- The amount transferred on a locked-in basis is limited by the Maximum Transfer Value (MTV) under 8517 of the Income Tax Act.
- The Commuted Values is determined as per the Ontario Pension Benefits Act and Canadian Institute of Actuaries Commuted Value standards using reasonable actuarial assumptions, post retirement indexing is included in the CV.
- The MTV is determined by a fixed annuity factor dependant on the age at transfer multiplied by the amount of post-age 65 lifetime retirement benefit (the "Normalized pension").
- If the Commuted Value exceeds the MTV limit, the amount above the limit is:
  - Subject to tax, and
  - May be payable:
    - in cash less withholding taxes; or
    - If a member has available RRSP room, the lump sum or a portion of the lump sum in excess of the MTV could be transferred, tax free, to the member's RRSP.
    - The amount in excess of the 8517 limit is taxable to the member (regardless of whether it is transferred directly to the member’s RRSP). However, the member will also receive a tax deduction for the contribution to the RRSP which will offset the amount that was in excess of 8517 limit.
6. **Learning Objectives:**
5. The candidate will understand how to evaluate and apply regulatory policies and restrictions for registered retirement plans.

**Learning Outcomes:**
(5f) The candidate will be able to describe and apply regulation pertaining to plan merger or spin-off.

(5h) The candidate will be able to describe and apply regulation pertaining to members’ rights.

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

**Sources:**
FR-129-16: Pension Asset Transfers made easier,
FR-131-19: FSCO Q&A on Asset Transfers for Plan Administrators and Actuaries,

**Commentary on Question:**
*A well-prepared candidate will be able to calculate the required assets to be transferred in accordance with Ontario regulations. They will also be able to describe the related benefit and disclosure requirements with respect to this transaction.*

**Solution:**
(a) Calculate the value of assets to be transferred at the effective date in order to receive regulatory approval for the asset transfer.

Show all work.

**Commentary on Question:**
*Most candidates were able to correctly identify the conditions required for regulatory approval of the transfer amount. However, many candidates had difficulty correctly calculating the transfer amount.*

Original Plan Solvency/Transfer Ratio = 430/420 = 1.024
Transfer amount = 120 * 1.024 = 122.86
6. **Continued**

A transfer of assets would not be authorized unless, after the transfer, at least one of the following conditions would be satisfied:

1) The solvency ratio of the successor plan (Plan A) after the transfer is at least 0.85.

   Plan A solvency ratio after transfer = \( \frac{290 + 122.86}{360 + 120} = 0.860 \)

   **Satisfied** \( (0.860 > 0.85) \)

OR

2) The solvency ratio of the successor plan (Plan A) after the transfer is,
   a) no more than 0.05 below the solvency ratio of the original plan (Plan X) before the transfer, **Not satisfied** \( (0.860 < (1.024 - 0.05)) \)
   and
   b) no more than 0.05 below the solvency ratio of the successor plan (Plan A) before the transfer.

   Plan A solvency ratio before transfer = \( \frac{290}{360} = 0.806 \)

   **Satisfied** \( (0.860 > (0.806 - 0.05)) \)

Therefore, the asset transfer of 122,860 would be approved.

(b) Describe the conditions that must be met with respect to the members’ benefits transferred to Plan A.

**Commentary on Question:**

*Candidates performed reasonably well in this section of the question, many correctly identifying several of the required conditions.*

1) DB assets must be used to provide DB benefits under the successor plan

2) The commuted value of the accrued benefits (to be provided under the successor plan) cannot be less than the commuted value of the benefits under the original plan determined as of the effective date of the asset transfer (adjusted for any payments from the original plan to a prescribed retirement savings arrangement or directly to the members).

3) The amount of accrued basic pension benefits under the successor plan must at least be equal to 85% of the accrued basic pension benefits under the original plan.

4) The transferred member is entitled in the merged (or successor) plan for the period of membership in the original plan for purposes of determining eligibility of membership and benefit entitlements in the successor plans.
6. Continued

(c) List the disclosure requirements for the cost certificate that is prepared following the completion of the asset transfer.

Commentary on Question:
Candidates did not perform quite as well in this section of the question, generally only identifying a couple of the disclosure requirements.

Within 60 days after a transfer of assets has been completed, a cost certificate (for both original and successor plans), prepared as at the effective date of the asset transfer should contain the following information:

1) An estimate of the normal cost of the plan for the fiscal year commencing on the valuation date of the certificate.
2) An estimate of the amount equal to the provision for adverse deviations in respect of the normal cost of the plan for the fiscal year commencing on the valuation date of the certificate.
3) An estimate of the total employee contributions to the plan to be made during that fiscal year.
4) The pension plan’s going concern assets, estimated going concern liabilities, estimated available actuarial surplus if applicable, solvency assets and estimated solvency liabilities, each determined as of the valuation date of the certificate.
5) The prior year credit balance.
6) Estimated liabilities for benefits, other than pension benefits and ancillary benefits payable under qualifying annuity contracts, that were excluded in calculating the solvency liabilities.
7) The estimated transfer ratio, calculated using the solvency assets and estimated solvency liabilities determined in the certificate.
8) If the pension plan is a public-sector pension plan, the estimated solvency ratio, calculated using the solvency assets and estimated solvency liabilities determined in the certificate.
9) It should also indicate the amount of assets transferred from the original pension plan to the successor pension plan.
7. **Learning Objectives:**

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

**Learning Outcomes:**

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

**Sources:**


Canada Revenue Agency PA Guide

Canada Revenue Agency PSPA Guide

Canada Revenue Agency PAR Guide

**Commentary on Question:**

*Commentary listed underneath question component.*

**Solution:**

(a) Calculate the 2019 Pension Adjustment for each member.

Show all work.

**Commentary on Question:**

Many candidates did not prorate the ITA Max to reflect the 0.5 year accrual for Member A. Most candidates correctly stated that PAs cannot be negative and are 0 in the year of death for members B and C.

2019 PA formula = (9 x 2019 DB accrual) – 600

<table>
<thead>
<tr>
<th>Member</th>
<th>Pension Plan Accrual</th>
<th>ITA Maximum Accrual</th>
<th>2019 PA Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.5% x $415,000 x .50</td>
<td>$3,026 x .50</td>
<td>$13,017</td>
</tr>
<tr>
<td>B, C</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

2019 PA formula = 9 x min($3,112.50, $1,513) – 600 = $13,017
7. Continued

Member B
Pension Plan Accrual = 1.5% x $45,000 x .0833 = $56.25
ITA Maximum Accrual = $3,026 x .0833 = $252.17
2019 PA formula = 9 x min ($56.25, $252.17) – 600 = (93.75)
If the PA is zero, leave the box blank: a PA cannot be less than zero.

Member C
No PA is reported for a deceased member in the year of death.

(b) Calculate the 2019 Pension Adjustment Reversal (PAR) for Member A.

Show all work.

Commentary on Question:
The added complication in this question was the inclusion of specified distributions. A significant number of candidates did not include the transfer made as a result of the marriage breakdown.

PAR = A + B – C – D where,
  A = Total pension credits (sum of Pas)
  B = Total grossed-up PSPAs
  C = Amount of specified distributions
  D = PA transfer amount

A = Total pension credits = Sum of PAs from Join to 2018 + 2019 PA
  = $420,000 + $13,017 = $433,017

B and D = 0

C = Amount of specified distributions = Sum of total payments made in respect of post 1989 service = $410,000 + $270,000 = $680,000

PAR = $433,017 + 0 – $680,000 – 0 = ($246,983) No PAR is reported since negative.

(c) Explain in words how each of the above improvements will affect the calculation of Past Service Pension Adjustments (PSPAs).

Commentary on Question:
Candidates answered this question very well. A small number of candidates wrongfully identified the change in the final averaging period as a change leading to a PSPA.
7. Continued

A PSPA is the sum of the additional pension credits that would have been determined for prior years if the RPP had provided for the upgraded benefits or additional period of pensionable service at the time each pension credit was first required to be determined.

The change from FAE 5 to FAE 3 does not lead to a PSPA as it has no impact on the PAs reported each year.

The change from 1.5% to 1.75% leads to a PSPA as the 1.75% accrual would have resulted in higher historical PAs compared to the 1.5% accrual.

(d) Calculate the Past Service Pension Adjustment (PSPA) for Member D.

Show all work.

Commentary on Question:
Candidates either did very well on this question, demonstrating their knowledge of the material, or performed poorly.

PSPA = A – B – C + D where,
   A = Total recalculated pension credits under new benefit accrual (sum of PAs)
   B = Total pension credits (sum of Pas reported)
   C = Qualifying transfers
   D = Excess money purchase transfer

C and D = 0

B = $70,155

ΣPAs = Total Benefit Accruals (BA) for 10 years * 9 – 600 * 10yrs of service

Total BA for 10 years = (ΣPAs + 600 * 10yrs of service) / 9
                      = ($70,155 + 6,000) / 9 = $8,461.67

Revised BA for 10 years = Total BA for 10 years * 1.75% / 1.50%
                         = $9,871.95

A = Revised BA for 10 years * 9 – 600 * 10yrs of service
   = $9,871.95 * 9 – 6,000 = $82,847.55 rounds to $82,848

PSPA = A – B – C + D = $82,848 – $70,155 – 0 + 0 = $12,693
7. Continued

(e) Explain why the PSPAs related to the improvement are exempt from certification.

The PSPAs are reportable because they meet the following criteria:

1. Plan must have at least 10 active members who are earning benefits under the Plan
2. Substantially all of the active members who are earning benefits under the plan’s defined benefit provision are receiving the improvement
3. Improvements in benefits are not more advantageous for inactive members than for active members
4. No more than 25% of the active members affected by the improvement are “specified active member” i.e. earn more than 2.5 times YMPE
5. Improvements not provided disproportionately to “specified active members”
8. **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:**
(1b) Assess data quality.

(1d) Comply with regulatory and professional standards pertaining to data quality.

(7a) Apply the standards related to communications to plan sponsors and others with an interest in an actuary’s results (i.e., participants, auditors, etc.).

(7d) Demonstrate compliance with requirements regarding the actuary’s responsibilities to the participants, plans sponsors, etc.

(7e) Explain and apply all of the applicable standards of practice related to valuing pension benefits.

**Sources:**
ASOP 23

CIA consolidated standards of practice – 1420, 1430, 1440

CIA Revised Educational Note: Events Occurring After the Calculation Date of an Actuarial Opinion for a Pension Plan

**Commentary on Question:**
*In general, part (a) was answered well, while part (b) was not answered well. Most candidates did not note that the event was a subsequent event and did not mention the required disclosures.*

**Solution:**
(a) Describe how you would test the sufficiency and reliability of the asset data for the purpose of the funding valuation. No calculations required.

- Match opening balance to closing balance at last valuation
- Compare employer contributions to Form 7 and/or contribution requirements determined from last valuation
- Compare ratio of employer/member contributions to plan formula
- Compare member contributions to amounts provided in membership data
- Compare investment return to benchmark returns based on investment policy
- Compare pensions paid to amounts provided in membership data
8. Continued

- Compare lump-sums paid to amounts provided in membership data
- Identify lump-sums paid in 2017 as large relative to other years and validate against amounts provided in membership data

(b) Explain how you would proceed, taking into consideration professional standards of practice. No calculations are required.

- Error should be considered a subsequent event.
- This represents a material change to results, thus need to re-file the report.
- Need to prepare a new opinion in new report to include information on the revised funded status of the plan (2 opinions would not apply here).
- New report would be subject to the normal requirements, e.g. opining upon the suitability of the membership data, methods, and assumptions as at the revised calculation date.
- The re-measurement of the funded status of the plan following the subsequent event should be considered in determining the funding requirements and/or other financial implications.
9. **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:**
Anderson, FR-132-17: A Problem-Solving Approach to Pension Funding and Valuation, Second Edition, Ch. 5

**Commentary on Question:**
A well-prepared candidate will be able to calculate unfunded liability and normal cost using the Individual Level Premium cost method. They will also be able to reconcile experience gains/losses in respect of these items.

**Solution:**
(a) Calculate the total normal cost as at January 1, 2019.

**Commentary on Question:**
Candidates performed reasonably well calculating the normal cost using the ILP method. There were several candidates who failed to recognize that this was not an initial valuation and that the Accrued Liability had been provided in the data.

\[
NC-ILP = \sum \left[ \frac{(PVFB_x - AL_x)}{PVFS_x \times S_x} \right] = \sum \left[ \frac{(PVFB_x - AL_x)}{a(y-x)j} \right]
\]

where \( j = \frac{(1+\text{salary scale})}{(1+\text{discount rate})-1} \)

**Employee A:**

\[
\begin{align*}
PVFB & = 1\% \times $50,000 \times 1.03^{25} \times 30 \times \ddot{a}_{60}^{(12)} \times v^{26} \\
& \quad = $130,726 \\
PVFS & = 50,000 \times \ddot{a}_{60}^{(12)} \times v^{26} \quad \text{where} \quad j = 1.05/1.03-1 = 50,000 \times 20.6576 \\
NC & = (130,726 - 20,000) / 20.6576 \quad \text{(salaries cancel out)} \\
& \quad = $5,360
\end{align*}
\]

**Employee B:**

\[
\begin{align*}
PVFB & = 1\% \times $100,000 \times 1.03^{15} \times 25 \times \ddot{a}_{60}^{(12)} \times v^{16} \\
& \quad = $264,077 \\
PVFS & = 100,000 \times \ddot{a}_{60}^{(12)} \times v^{16} \quad = 100,000 \times 13.9054 \\
NC & = (264,077 - 100,000) / 13.9054 \quad = 11,800 \\
Total NC & = 5,360 + 11,800 = $17,160
\end{align*}
\]
9. Continued

(b) Calculate the total unfunded actuarial liability and total normal cost as at January 1, 2020.

**Commentary on Question:**
Most candidates were able to correctly determine the assets and the Accrued Liability for Employee A. Many candidates also recognized that the Accrued Liability was the “rolled-forward” expected liability from the previous year. However, most candidates had difficulty calculating the new Normal Cost for Employee B.

\[
\text{ILP AL}_x = (\text{AL}_{x-1} + \text{NC}_{x-1}) \times (1+i)
\]

\[
\text{UAL}_x = \text{AL}_x - F_x
\]

\[
F_x = 120,000 \times 1.0 + 20,000 = 140,000
\]

**Employee A: (Deferred Member)**

\[
\text{AL}_1 = 1\% \times 50,000 \times 5 \times \ddot{a}_{60}^{12} \times v^{25} = 10,926
\]

**Employee B:**

\[
\text{AL}_1 = (\text{AL}_0 + \text{NC}_0) \times 1.05 = (100,000 + 11,800) \times 1.05 = 117,390
\]

\[
\text{PVFB} = 1\% \times 100,000 \times 1.10 \times 1.0314 \times 25 \times \ddot{a}_{60}^{12} \times v^{15} = 296,126
\]

\[
\text{PVFY} = 110,000 \times \ddot{a}_{16} = 110,000 \times 13.1560
\]

\[
\text{NC} = (296,126 - 117,390) / 13.1560 = 13,586
\]

\[
\text{Total AL}_x = 10,926 + 117,390 = 128,316
\]

\[
\text{UAL}_x = 128,316 - 140,000 = ($11,684)
\]

\[
\text{Total NC} = 0 \text{ (Mbr A deferred)} + 13,586 = $13,586
\]

(c) Calculate the liability gains and losses by source for 2019.

**Commentary on Question:**
Candidates performed reasonably well in this section of the question, many correctly identifying several of the sources of gains/loss. Some candidates did not realize that there would not be any salary gain/loss under this funding method.

\[
\text{Exp'd UAL}_1 = \text{UAL}_0 \times 1.05
\]

\[
= (120,000 - 120,000) \times 1.05 = 0
\]

\[
\text{Act'l UAL}_1 = (11,684) \text{ (see above)}
\]

\[
\text{Gains/(Losses)} = 0 - (11,684) = 11,684
\]

Gain on contributions:

\[
\text{Exp'd NC} = 17,160 \times 1.05 = 18,018
\]

\[
\text{Act'l Conts} = 20,000 \times 1.05 = 21,000
\]

\[
\text{Gain/(Loss)} = 21,000 - 18,018 = 2,982
\]
9. Continued

Gain on fund return:
Act'l F = 140,000 (see above)
Exp’d F = (120,000 + 20,000) x 1.05 = 147,000
Gain/(Loss) = 140,000 – 147,000 = (7,000)

Gain on termination – Member A:
Exp’d AL = (20,000 + 5,360) x 1.05 = 26,628
Act’l AL = 10,926 (see above)
Gain/(Loss) = AL_{exp} – AL_{act} = 26,628 – 10,926 = 15,702

Check:
Gains/(Losses) = 2,982 + (7,000) + 15,702 = 11,684

(d) Calculate the gains and losses on the total normal cost by source for 2019.

Show all work.

Commentary on Question:
Candidates did not perform as well in this section of the question. In particular, many candidates omitted this portion of the question.

Exp’d NC\_1 = NC\_0 x 1.03
= 17,160 x 1.03 = 17,675
Act’l NC\_1 = 13,586 (see above)
Gains/(Losses) = 17,675 – 13,586 = 4,089

Gain on termination – Member A:
Exp’d NC = 5,360 x 1.03 = 5,521
Gain/(Loss) = NC_{exp} – NC_{act}
= 5,521 – 0 = 5,521

Loss on salary increase – Member B:
Exp’d NC = 11,800 x 1.03 = 12,154
Act’l NC = 13,586 (see above)
Gain/(Loss) = NC_{exp} – NC_{act}
= 12,154 – 13,586 = (1,432)

Check:
Total Gains/(Losses) = 5,521 – 1,432 = 4,089
10. **Learning Objectives:**
3. The candidate will understand how to apply/synthesize the methods used to value pension benefits for various purposes.

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

**Learning Outcomes:**
(3c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding methods

(6a) Evaluate retirement funding alternatives for the plan sponsor, shareholders and the participants, and, for public pension plans, taxpayers.

**Sources:**
Study Note: Funding of Public Sector Pension Plans

**Commentary on Question:**
*Commentary listed underneath question component.*

**Solution:**
(a) Describe the perspectives of the following stakeholders with respect to intergenerational equity in public sector pension plans:

(i) Government budget office;

(ii) Covered employees; and

(iii) Advocates for other public services.

**Commentary on Question:**
*Most candidates were able to identify some points under each of the stakeholders; however, for the employees’ perspective, benefit security was often mentioned without the specifics outlined in the study note.*

(i) **Government budget office:**
- Tax payers should pay for the same cost, as percentage of pay, for pension benefits
- They want a stable pension cost over time
- If a large funding shortfall arises, may decide to cut future benefits for younger employees to make room for funding accrued benefits of older employees
10. Continued

(ii) **Covered employees:**
- Employees who perform the same service should receive the same pension benefits regardless of when they are employed
- Unfavorable plan experience could result in rising taxes to fund benefits

(iii) **Advocates for other public services:**
- Accrued pension benefits are not paid until some point in the future, so taxpayers may not want to fully pay the cost
- especially if this means cutting back on other essential services such as health or education
- This may shift costs from today’s taxpayers to future taxpayers, and the absence of advance funding may reduce the security of benefits

(b) Compare and contrast the following cost methods with respect to intergenerational equity when funding public sector pension plans:

(i) Unit Credit; and

(ii) Entry Age Normal.

**Commentary on Question:**
*Most candidates identified the key difference in how costs evolve between Unit Credit and EAN, and its impact on intergenerational equity, but often did not include commentary on the characteristics of the methods that lead to that difference.*

<table>
<thead>
<tr>
<th>Unit Credit</th>
<th>Entry Age Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>The normal cost increases as the plan member ages</td>
<td>The cost of pension benefits is allocated over the service periods of plan members, so the allocated costs are as level as possible</td>
</tr>
<tr>
<td>The funding normal cost is often reflected as a fixed rate per participant</td>
<td>The target normal cost rate is based on the attributes of new entrants</td>
</tr>
<tr>
<td>The rate would be higher than the UC normal cost for younger members and lower than the UC normal cost for older members</td>
<td>Using a level normal cost method such as EAN would allow pension benefits to be funded over the service periods of the participants in that generation</td>
</tr>
<tr>
<td>The contribution rate developed under the UC method would shift the funding burden to future taxpayers</td>
<td>This would limit shifting costs from today’s taxpayers to future taxpayers</td>
</tr>
</tbody>
</table>
11. **Learning Objectives:**

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

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

**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.

(6a) Evaluate retirement funding alternatives for the plan sponsor, shareholders and the participants, and, for public pension plans, taxpayers.

**Sources:**


A practical approach to establishing margins for adverse deviations in going-concern funding valuations

Provisions for adverse deviations in going –concern actuarial valuations

Determination of best estimate discount rates for going concern funding valuations

CIA Consolidated standards of practice – 3100—3500

**Solution:**

(a) Describe the two approaches that may be taken when selecting a best estimate discount rate for going concern valuations, including the steps involved for each approach.

Two approaches to setting the best estimate assumption going concern discount rate:

1. Based on expected future investment returns on the assets of the pension plan. One accepted methodology for establishing a best estimate discount rate that reflects expected future investment returns is a building block approach with the following steps:
   - Determine best estimate long-term return for each asset class;
   - Combine best estimate long term returns for each asset class reflecting the plan asset allocation under the investment policy (with consideration for effect of diversification and rebalancing, and reflecting risk-free rate/equity risk premium/fixed-income risk premium);
11. Continued

- Consider inclusion of an allowance for additional return from active management, where appropriate, and make appropriate provision for expenses.
- Discount rate should be based on a best estimate of the expected future investment return on the plan’s assets over a relevant time frame. Typically, this will be a long-term horizon such as 20–30 years but a shorter-term perspective may be needed for very mature plans.

Best estimate discount rate reflecting an asset mix glide-path:
- Plan asset mix will be gradually shifted from equities into long bonds, when there is a funded status improvement trigger met. The final trigger to occur when the plan is 100% funded, projected to occur after \(N\) years (taking into account the glide-path, expected asset returns, expected growth in liabilities, funding requirements/policy).
- Going-concern discount rate set assuming that the asset mix is gradually shifted from current equity allocation to end point target equity allocation over the first \(N\) years following the valuation date, and then remains fixed thereafter.

2. Based on the yields of investment grade debt securities, considering the expected future benefit payments of the pension plan. The plan’s target asset mix is irrelevant under this approach. Steps and considerations:
- Determine yields of investment grade debt securities that would reasonably match the projected benefit cash flows or have a duration comparable to that of the projected benefit cash flows.
- Select and ultimate rates may be used to approximate the effect of using a full yield curve.
- If the fixed income investments mature prior to the expected payment of all projected benefit cash flows, consider making an allowance for reinvestment and the effect of possible changes in interest rates on future investments.
- Take into account appropriate allowance for future plan expenses that are expected to be paid from the pension fund.

(b) Calculate the total going concern liabilities and the normal cost including the PfAD as at January 1, 2019 for the plan.

Best estimate GC discount rate = 6.3%
Allocation of fixed income = 55% on fixed income + 50%*10% on real estate = 60%
11. Continued

Benchmark Discount Rate (BDR) = base rate of 0.5% + Government of Canada Long Bond Yields + 5% x allocation of non-fixed income + 1.5% x allocation of fixed income
= 0.5% + 2.18% + 5%*0.40 + 1.5%*0.6 = 5.58%

PfAD has three components:
- Fixed component: closed plan => 5%
- Component based on asset mix: 40% on non-fixed income => 4%
- Component based on GC discount rate in the event that GC discount rate exceeds BDR = Duration x (GC Discount rate - BDR) = 15 x (6.3% - 5.58%) = 15 x 0.72% = 10.8%

PfAD = 5% + 4% + 10.8% = 19.8%

PfAD on the going concern liabilities = 19.8% of GC non-indexed = 19.8% X 10,000,000 = $1,980,000
PfAD on the normal cost = 19.8% of NC non-indexed = 19.8% X 500,000 = $99,000

(c) Explain how to determine a margin for adverse deviation when it is not prescribed by regulation.

A practical approach to establishing a discount rate margin for incorporation in the going concern discount rate could consider the following desirable properties:

- Plan’s Investment policy: margin is higher for plans that adopt a riskier investment policy. The higher the proportion of pension fund invested in non-fixed income assets, the higher the discount rate margin required;
- Plan maturity: margin higher for mature plans than for less mature plans; and
- Current level of long-term interest rates: it moves with long-term interest rates that fall within a specified range—a higher (lower) margin is applied when interest rates move up (down).
12. **Learning Objectives:**

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

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

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

**Learning Outcomes:**

(3a) Differentiate between the various purposes for valuing pension plans:
   (i)   Funding
   (ii)  Solvency
   (iii) Termination/wind-up/conversion

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

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

(6b) Evaluate funding restrictions imposed by regulations.

**Sources:**

FR-142-19: 2018 Funding Reform - Ability to take contribution holidays and pay PBGF assessments


Pension Benefit Act


**Commentary on Question:**

*For part (a) and (b) of this question, candidates were tested on their understanding of the requirement and the specific use of available actuarial surplus under the Pension Benefit Act (PBA). Candidates answering ‘contribution holiday’ under part (b) without specifying the reduction of normal cost and pfad of normal cost were not awarded full credit.*

*For part (c) of this question, candidates were tested on their understanding of the calculations and requirements of maximum and minimum employer contributions under the PBA. Most candidates did well in this part.*
12. Continued

*For part (d) of this question, candidates were tested on performing extrapolations of the plan’s funded status, then to determine the new maximum and minimum contribution requirements.*

**Solution:**

(a) Describe the requirements for there to be an available actuarial surplus for a defined benefit pension plan registered in Ontario.

The requirement of available actuarial surplus.

- PfAD fully funded
- Transfer ratio is at least 1.05

(b) Describe the possible applications of available actuarial surplus.

Use of available actuarial surplus:

- Reduce normal cost contributions, including contributions for the provision for adverse deviations (“PfAD”) in respect of the normal cost
- Any actuarial surplus not applied to reduce normal cost and PfAD can be used to pay PBGF fees

(c) Calculate the minimum required and maximum permissible employer contributions at January 1, 2019 for the DPC plan.

Show all work.

2019
Minimum contributions = NC + PfAD on NC + Special payments
NC = 42,705
PfAD = 2,913
Special payments = 0, as solvency ratio > 85%
2019 Minimum contributions = $45,618
12. Continued

Maximum permitted contributions = NC + PfAD + Max (GC deficit, HWU deficit)
NC = 42,705
PfAD = 2,913
HWU deficit = 284,357
2019 minimum contributions = 329,975

(d) Calculate the estimated minimum required and maximum permissible employer contributions for 2020 using extrapolated liabilities.

Commentary on Question:
Other methods other than the methods used below for extrapolating were also accepted, provided that followed the appropriate actuarial principles.

Estimated Assets at 1/1/2020 (roll forward)
MV 1/1/19 + interest - BP with interest + contribution at EoY (no interest)
1,237,947 * (1.20) – 31,000 *1.20 ^ .5 + 284,357
= 1,735,936

Estimated GC liabilities 1/1/20 (roll forward)
GC 1/1/19 with interest + NC with interest - BP with interest
= 1,154,191 * 1.0525 + 42,705 * 1.0525 - 31,000 * 1.0525^.5
= 1,227,930

Estimated PfAD on GC liabilities 1/1/20 (roll forward)
= [1,043,463 * 1.0525 + 38,335 * 1.0525 - 31,000 * 1.0525^.5] x 7.6%
= 1,106,789 x 7.6% = 84,116

Estimated windup Liabilities 1/1/20 (roll forward) <this solution used an average of 3% as a proxy for blended rate>
windup 1/1/19 with interest + SIC with interest - BP with interest
= 1,521,304 * 1.03 + 251,842 * 1.03 - 31,000 * 1.03^.5
= 1,794,879

GC surplus = 1,735,936 - 1,227,930 – 84,116 = 423,890 (132%)
Wind up deficit = 1,735,936 – 1,000- 1,794,879 = (59,943) (97%)

2020
Minimum contributions = NC + PfAD on NC + Special payments
Normal cost + PFAD on NC: 222,726 * 20.5% = 45,659, based on 2020 pensionable earnings including pfad
Special payments = 0, as solvency ratio > 85%
2020 Minimum contributions = 45,659

OR
12. Continued

Maximum permitted contributions = NC + PfAD + Max (GC deficit, HWU deficit)
Normal cost + PFAD on NC: $222,726 \times 20.5\% = 45,659$, based on 2020 pensionable earnings including pfad
HWU deficit = 59,943
2020 maximum contributions = 105,602