RET FRC Model Solutions
Spring 2015

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.

7. The candidate will understand how to apply the standards of practice and guides to professional conduct.

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

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

(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.).

(7b) Explain and apply the Guides to Professional Conduct.

(7c) Explain and apply relevant qualification standards.

(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.

(7f) Recognize situations and actions that violate or compromise Standards or the Guides to Professional Conduct.

(7g) Recommend a course of action to repair a violation of the Standards or the Guides to Professional Conduct.

1. **Continued**

Sources:
FR-100-13 - ASOP 23 Data Quality

CIA Consolidated Standards of Practice - 1000-1800

CIA Consolidated Standards of Practice - Pension Plans 3100-3500

Commentary on Question:
Numerous candidates did not recognize that they were provided with information that the data change in (i) resulted in an immaterial change in results. The candidates indicated that they had to check to determine that the data change did not have a material change.

Some candidates indicated that even though the data change was immaterial, if time permitted and it was not too costly, the report should be changed to recognize the corrected membership data.
Numerous candidates did not recognize that a significant downsizing after the valuation date should not be included in determining the financial results of the valuation report.

Solution:
(a)   Propose appropriate actions to be taken for each of the following situations that recently came to your attention:

      (i)   a retroactive immaterial data change.

      (ii)   a change in the target asset mix after the valuation date.

      (iii)   a significant downsizing after the valuation date.

Commentary on Question:
Candidates were provided full credit where they indicated the appropriate action to be taken and provided justification for the proposed action. Candidates were not provided with credit where they stated conflicting actions that could be taken.

      (i)   No change to the valuation report is necessary as the data change is not material.

      (ii)   The change in the target asset mix may change the going-concern discount rate since the discount rate is based on the best estimate long-term rate of return, provision for expenses and provision for adverse deviation.

              Changes to the discount rate can affect the going-concern financial position, current service costs, minimum required contributions and maximum contributions.

1. Continued

If the discount rate based on the revised target mix is equal to the current discount rate, there would be no change in the financial results of the report and, as such, the valuation results in the report do not need to be revised.

If the updated discount rate is different from the current discount rate, there may or may not be a material change in the going-concern position, current service costs, minimum required contributions and maximum contributions.

If the updated discount rate does not have material change on the financial results of the valuation, the valuation results in the report do not need to be revised.

If the updated discount rate has a material change on financial results of the valuation, the report must be changed to recognize the updated discount rate and include a description of the change in the asset mix along with the impact on the financial results of the valuation.

(iii)   Since this event occurs after the calculation date, and the purpose of the work is to report on the entity as it was at the calculation date, the financial results of the report are not changed.

The report will need to be modified to disclose the downsizing as a subsequent event and explain that this event has not been taken into account in the report and will be taken into account in future advice.

(b)   Explain how your proposed actions in (a) would differ if the report had already been filed.

Commentary on Question:
Candidates were provided with full credit for part (ii) if they indicated that a revised report is not required if the change in the target mix resulted in a material change to the discount rate and they provided a valid argument for not revising the report, such as, the change in the target asset mix does not invalidate the report. No credit was awarded where the reason provided contradicted the proposed action.

1. Continued

(i)   No action is required; no change to the valuation report is necessary.

(ii)   If the discount rate based on the revised target mix is equal to the current discount rate, no action is required.

If the updated discount rate does not have material change on the financial results of the valuation, no action is required.

If the updated discount rate has a material change on financial results of the valuation, the report must be withdrawn and refilled due to the fact that the change in the target mix retroactively makes the plan's financial position different as at the valuation date. The report is to be revised to recognize the updated discount rate and include a description of the change in the asset mix along with the impact on the financial results of the valuation.

(iii) No action is required.

2. **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:

(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:

Morneau Shepell handbook of Canadian Pension and Benefit Plans, 15th edition, Chapter 8

Canadian Pensions and Retirement Income Planning, Towers Watson, 4th edition, Chapter 15

FR-114-13: Ontario Pension Benefits Act R.R.O 1990, Reg 909

FR-115-13: Ontario Pension Benefits Act, R.S.O 1990 Ch p.8

Commentary on Question:
The question was testing the candidate's ability to determine funded positions and contribution requirements at two different dates. The candidate was also asked to provide uses of surplus for an employer.

Most candidates were able to complete (a) and b(i) well but struggled with b(ii). Most candidates were able to get partial marks for part (c) as they described the key potential uses of surplus.

Solution:

(a)   Calculate the total 2014 employer contribution assuming the employer contributes as per the funding policy.

Show all work.

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2. Continued

Commentary on Question:
Overall this part of the question was done well by candidates. Common mistakes were to not include the DC contributions with the total contributions. The annuity factors were not calculated correctly by most candidates.

2014 DC Contribution = $25,000,000 x 6% = $1,500,000
GC Funded Status = $18,000,000 - $19,000,000 = ($1,000,000) -> deficit
Solvency Funded Status = $18,000,000 - $100,000 - $21,000,000 = ($3,100,000) -> deficit
Present Value of Current Special Payments on a going concern basis
$50,000 / 12 * Annuity Factor for 168 rem. months at 5.5% = $50,000 / 12 * 117.95 = $491,458
Present Value of Current Special Payments on a solvency basis
#1 -> ($50,000 / 12) * Annuity Factor for 60 rem. months at 3.8% = ($50,000 /12) * 54.65 = $227,708
#2 -> ($150,000 / 12) * Annuity Factor for 36 rem. months at 3.8% = ($150,000 /12) * 34.01 = $425,125
#3 -> ($400,000 / 12) * Annuity Factor for 48 rem. months at 3.8% = ($400,000 /12) * 44.52 = $1,484,000
New Special Payments Going Concern
Remaining Deficit to amortize over 15 years = Current GC Deficit – PV of Current Special Payments (GC) = $1,000,000 – $491,458 = $508,552
New GC Special Payment = $508,552 / (annuity factor for 180 remaining months at 5.5%)
= $508,552 / (10.288) = $49,429 annual payment
New Special Payment - Solvency
PV of new GC Special Payment for 60 months = ($49,429 /12) * annuity factor for 60 remaining months at 3.8% = ($49,429 /12) * 54.65 = $225,108
Remaining Deficit to amortize over 5 years = Current Solvency Deficit – PV of Current Special Payments (GC) for 60 months – PV of Current Special Payments (Solvency) = $3,100,000 – $227,708 – $425,125 - $1,484,000 - $225,108 = $738,059
New Solvency Special Payment = $738,059/ (annuity factor for 60 remaining months at 3.8%)
= $738,059/ (4.554) = $162,062 annual payment
2014 special payments = $50,000 + $49,429 + $150,000 + $400,000 + $162,062 = $811,491
Total 2014 Employer Contribution = DC CSC + DB CSC + Special Payments = $1,500,000 + $300,000 + $811,491 = $2,611,491

2. **Continued**

(b)   Calculate the following:

(i)   The funded position of the DB component of the plan as at January 1, 2015 on a going concern and solvency basis.

(ii)   The total 2015 maximum and minimum statutory contributions for the plan.

Show all work.

Commentary on Question:
Part (i) was done well by most candidates. However simple mistakes were made in the liabilities and/or assets roll forward. Common mistakes were to not include the benefit payments in the roll forward and to include the DC contributions in the DB asset roll forward. Also interest was not credited properly in many cases. By making common mistakes in (i) a lot of candidates ended up with an excess surplus for (ii). Partial marks were given for determining the contribution requirements based on excess surplus.

(i)   Asset Roll forward = \$18,000,000*(1+20%) + \$1,111,491*(1+20%/2) + \$2,000,000 - \$2,000,000*(1+20%/2) = \$22,622,640
Liability Roll forward = (\$19,000,000 + \$300,000)*(1+5.5%) - \$2,000,000 * (1+5.5%/2) = \$18,306,500
Solvency Liability Roll forward = (\$21,000,000 + \$400,000)*(1+3.8%) - \$2,000,000*(1+3.8%/2) = \$20,175,200
GC Funded Status = \$22,622,640 - \$18,306,500 = \$4,316,140 -> surplus -> 123.6% funded
Solvency Funded Status = \$22,622,640 - \$100,000 - \$20,175,200 = \$2,347,440 -> surplus

(ii)   Previously established special payments on GC or solvency basis are eliminated
Surplus on GC basis since funded ratio, but not excess surplus as < 125%
Maximum allowable contribution is DB current service cost + DC contributions
2015 DC Contribution = \$25,000,000 x 1.035 (salary scale) x 6% = \$1,552,500
DB current service cost = \$310,500 = \$300,000 x 1.035 (salary scale)
Max Contribution = Total DB current service cost plus DC contribution = \$1,863,000 = \$310,500 + \$1,552,500
Minimum required contribution is Total DB current service cost plus DC contribution less application of going concern surplus
  Minimum required contribution is: \$0 = Greater of (\$1,863,000 - \$4,316,140) and \$0

2.   Continued

(c)   Describe the potential uses of the surplus and any associated implications, assuming the plan has a going concern and solvency surplus.

Commentary on Question:
Most candidates were able to get a few of the key uses of surplus. Quite a few candidates discussed using a PYCB which, although applicable for this situation, is not a use of surplus.

The following is subject to any terms and conditions that prohibit the use of surplus that could be contained in relevant pension plan documentation such as the plan text, trust agreements, collective agreements, etc.
- Employer can take a contribution holiday with regards to their current service cost contribution if the plan is in surplus.
- Employer must take a DB contribution holiday if there is a going concern surplus in excess of 25% of going concern liabilities as per the Income Tax Act.
- Employer can use DB surplus towards employer required DC contributions, effectively taking a contribution holiday for both the DB & DC requirements.
- Employer makes an outright withdrawal of surplus. Employer may only withdraw surplus following approval from Financial Services Commission of Ontario (FSCO)

Employer can use surplus to upgrade benefits for actives, deferreds and/or pensioners; however employers should be aware of the long term cost impacts of the benefit improvements for funding and accounting. Employers should also consider any changes in the financial position since the surplus was first determined. Surpluses are often notional and can change depending on the valuation date. Short term or ad hoc benefit improvements (i.e. ad hoc pension increase) are preferable over longer term promises.

Increase margin reflected in going concern discount rate, lower discount rate, higher GC liabilities, lower GC surplus, and higher GC service cost

If the employer wishes to reduce the reported surplus, the actuary could value the maximum permissible benefits under the Income Tax Act and Regulations for the plan as a mechanism to move the plan to a more manageable surplus level and/or move it out of excess surplus position.

For example,
- Value post-retirement indexing at 100% of consumer price index, even though the pension plan may not explicitly grant guaranteed indexing
- Value career-average benefits as final average benefits.
- Immunize the asset portfolio to reduce exposure to equity. This will likely reduce the going concern discount rate and reduce or eliminate the going concern surplus.

3. **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.

(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-111-13: OSFI Guidelines for converting DB to DC

FR-113-13: Converting Pension Plans from DB to DC

Commentary on Question:

The question was testing the candidate's knowledge of the Ontario and OSFI guidelines for converting DB to DC

Solution:

(a) Critique NOC's proposed conversion basis given that the pension plan is registered in Ontario.

Commentary on Question:

Generally candidates did well on this part of the question. Most were able to identify that there was a problem with the minimum CV standards, discount rate, salary scale, retirement age and marriage assumption.

A successful candidate would have properly identified at least 5-6 of the violations listed below for the conversion basis.

Candidates who did not do well on this question mainly omitted some of the points listed below.

Minimum standard

The commuted value of benefits converted from DB to DC cannot be less than the value of the benefits to which the member would be entitled if the member terminated employment on the date of conversion.

Discount Rate

Discount rate of 7% is too high (NOC uses a 5.50% DR in its funding valuation).

3. Continued

Salary Scale

Benefits are based on final average earnings, therefore the sponsor must include a reasonable projection of salaries in the conversion values. Cannot use a salary scale of 0%.

The salary projection can take into account reasonable assumptions regarding future rates of termination and retirement.

Retirement Age

Retirement age of 65 may be too high considering the unreduced age of 62.

Marriage Assumption

Cannot assume all members are single. Normal form with spouse is more generous (60% J&S)

Professional standards

Professional standards (CSOP, Code of Conduct, etc.) need to be adhered to and unrealistic assumption unlikely to do so.

(b) Explain how your response to (a) would change if the pension plan was Federally regulated.

Commentary on Question:
Generally candidates did poorly on this part of the question.

Candidates who did not do well on this question mainly failed to list most of the points below.

CIA Transfer Value

Economic assumptions used in the transfer basis must be at least as favourable to the member as the CIA Transfer value basis:

Discount Rate

Discount rate still not acceptable since much higher than CIA transfer value basis

Salary Scale

Salary scale must be used since benefit is based on final average salary

Retirement Age

Retirement age is inappropriate since need to take into account ancillary benefits available if plan were not converted.

3. Continued

Plan Provisions
Must include provision for all benefits provided under the terms of the plan.

Unisex
Sex-distinct factors can only be used to the extent that an annuity for members will be purchased on a sex-distinct basis from the DC plan upon retirement.

Professional standards
Professional standards (CSOP, Code of Conduct, etc.) need to be adhered to and unrealistic assumption unlikely to do so.

4.

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 and asset valuation methods.

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

Sources:
Pension Mathematics for Actuaries, Anderson, 3rd Edition, Chapter 2

Morneau Shepell, Handbook of Canadian Pension and Benefits Plans, 15th Edition, Chapter 5

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Describe the advantages and disadvantages of using the following cost methods from XYZ's perspective:

        (i)   Projected Unit Credit (PUC) cost method; and

        (ii)   Entry Age Normal (EAN) cost method.

    Commentary on Question:
    The candidates were asked to describe the advantages and disadvantages of PUC and EAN. The expectations were that candidates would focus on the timing and volatility of contributions, as well as secondary effects of those elements on XYZ. Candidates did well at discussing the impact on the contributions of choosing one method versus the other, but only few candidates related the impact to XYZ.

    Projected Unit Credit

    Advantages
    *   PUC results in lower contributions in early years compared to EAN
    *   Lower initial contributions allow XYZ to invest in other business initiatives and possibly achieve higher after-tax return by using cash for other purposes
    *   Method accepted by accountants

4. Continued

Disadvantages
- For a closed group similar to XYZ's, cost associated with future years will tend to increase steadily (and sometimes steeply) due to aging of population and compounding of interest
- Normal cost could increase more quickly than payroll, leading to budget challenges for XYZ
- Less tax advantages from tax deductible contributions compared to EAN
- Less benefit security compared to EAN.

Entry Age Normal

Advantages
- Stable contributions over working lifetime
- Avoid increasing contributions requirement for a closed group
- More tax advantages and benefit security compared to PUC due to more advance funding

Disadvantages
- Higher contributions requirements in early years, leading to lower cash available for investments in other business initiatives
- Might not have access to surplus if plan becomes overfunded

(b) Describe the advantages and disadvantages of using the following cost methods from XYZ's perspective.

(i) Aggregate cost method; and

(ii) Individual Level Premium (ILP) cost method.

Commentary on Question:
The candidates were asked to describe the advantages and disadvantages of Aggregate method and ILP. The expectations were that candidates would focus on the timing and volatility of contributions, more specifically in the context of a plan with unfunded accrued liability, as well as secondary effects of those elements on XYZ. Candidates did well at discussing which method was most appropriate for a plan with unfunded accrued liability. However, few candidates described the considerations regarding level and volatility of contributions under Aggregate and ILP.

4. Continued

Aggregate

Advantages
- Aggregate results in lower contributions in early years compared to ILP
- Lower initial contributions would allow XYZ to invest in other business initiatives and possibly achieve higher after tax return by using cash for other purposes

Disadvantages
- More useful for plans with no initial unfunded accrued liability
- Normal cost could increase quickly
- Less tax advantages from tax deductible contributions compared to ILP
- Normal cost sufficient in aggregate, but overstated/understated on an individual basis

Individual Level Premium

Advantages
- More adequate to fund retroactive service initially
- Higher initial contributions compared to aggregate method, resulting in additional tax deductions and benefit security
- Each person's projected benefit funded over his career

Disadvantages
- Changes in projected benefits provided in increments of normal cost rather than gain/loss
- Higher contribution requirements in early years, leading to lower cash available for investments in other business initiatives
- Might not have access to surplus if plan becomes overfunded

5. **Learning Objectives:**
4. The candidate will understand the principles and rationale behind regulation.

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

Learning Outcomes:
(4b) Describe sources and framework of government regulation.

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

Sources:
Morneau Shepell, Handbook of Canadian Pension and Benefits Plans, 15th Edition, Chapters 5 and 29

Rebuilding New Brunswick: The Case for Pension Reform

Commentary on Question:
Commentary listed underneath question component.

Solution:
Describe in words the potential impact of the Union's request on the level and volatility of NOC's contributions under:

(i) The current plan structure and funding policy; and

(ii) The SRPP model.

Commentary on Question:
Candidates were asked to describe the impact of both models on the level and volatility of contributions. Most candidates provided complete responses under the current plan structure scenario. However, many candidates did not relate the characteristics of the SRPP model to the level and volatility of contributions in a satisfactory manner.

(i) **Current plan structure and funding policy**

- Increase in normal cost: More generous indexation formula (addition of pre-retirement indexation and more generous post-retirement indexation) resulting in higher cost of accrual.
- Increase in special payments required to fund deficits: immediate increase in going-concern and solvency liabilities resulting from more generous indexing formula.

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5.   Continued

- Increase in volatility of financial position and contributions: Indexation formula linked to CPI, which is unknown, increases volatility of contributions and risk exposure of the plan. NOC could decide to manage this additional risk through asset mix.

(ii)   SRPP model

- Decrease in normal cost: Ancillary benefits like indexation are funded through surplus resulting from gains and margin, rather than normal cost. Therefore, normal cost is reduced under the SRPP model
- More contribution stability: Benefit grows in more predictable manner as ancillary benefits are funded through surplus above a certain level and benefit accrual can be adjusted if plan is underfunded and therefore reduces volatility of the normal cost
- SRPP is subject to more risk management than regular funding valuations to avoid major shifts in contribution levels

6. **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:
(3e) Calculate actuarially equivalent benefits.

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

Sources:
FR-105-13 – Actuarially Equivalent Benefits

Towers Watson – Canadian Pensions and Retirement Income Planning ,Chapter 17

Commentary on Question:
In this question, candidates are asked to demonstrate their ability to calculate the pension payable under normal and options forms under the Income Tax Act. A well prepared candidate will be able to demonstrate a good understanding of the ITA limit and the value of optional forms. Also, a well prepared candidate will be able to understand the relationship of between interest rates in different optional forms.

Solution:
(a) Calculate the monthly pension benefit payable under the normal form of payment.

Show all work.

Calculate pension benefit under normal form.
Calculate Plan Annual Benefit:
2% x FAE x Credited Service x ERF
FAE = $165,000
Credited Service = 25 Years
Annual Plan Benefit = 2% x $165,000 x 25 = $82,500
(Monthly Plan Benefit = $82,500 / 12 = $6,875)

Check and calculate member is unreduced at retirement:
Age + Service = 62 + 25 = 87, > 85 points, unreduced
ERF = 0

Monthly Plan Benefit = $6,875

6. **Continued**

Calculate the ITA maximum benefit payable

Calculate Pension Payable under ITA Limit

ITA Limit = DB Limit x Credited Service x ITA ERF

ITA ERF = 0.25% per month from the earlier of
1. Age 60 (Yes, met criteria)
2. 30 years of service (No, does not meet criteria)
3. 80 Points (Yes, meets criteria)
~Unreduced ITA Limit

Annual DB Limit = $2,770 x 25 x 100% = $69,250
Monthly DB Limit = $5,770.83

Identify that the member's pension benefit exceeds the ITA limit and will be capped by the ITA limit.

Benefit payable = min of ($6,875, $5,770.83) = $5,770.83

(b)   Calculate the monthly pension benefits payable under the following optional forms of payment.

Determine index rates for actuarial equivalence calculation
Government of Canada Rates are semi-annual, thus need to annualize rates:
$i7 = (1+2.17\%/2)^2 - 1 = 2.182\%$
$iL = (1+3.20\%/2)^2 - 1 = 3.226\%$
$rL = (1+1.22\%/2)^2 - 1 = 1.224\%$

Non-Index Rates
$i1\text{-}10 = i7 + 0.9\% = 2.182\% + 0.9\% = 3.082\%$ rounded to 3.10%
$i10+ = iL + 0.5 * (iL - i7) + 0.9\%$
$= 3.226\% + 0.5* (3.226\% - 2.182\%) + 0.9\% = 4.648\%$ rounded to 4.6%

Indexed Rates
$r7 = rL \times (i7 / iL) = 1.224\% \times (2.182\%/3.226\%) = 0.8279\%$
$r1\text{-}10 = r7 + 0.9\% = 0.8279\% + 0.9\% = 1.728\%$ rounded to 1.70%
$r10+ = rL + 0.5 * (rL - i7) + 0.9\%$
$= 1.224\% + 0.5* (1.224\% - 0.8279\%) + 0.9\% = 2.3221$ rounded to 2.3%

Implied Inflation Rates
$u1\text{-}10 = (1+i1\text{-}10)/(1+r1\text{-}10)-1 = (1+3.08\%)/(1+1.73\%)-1 = 1.330\%$
$u10+ = (1+i10)/(1+r10)-1 = (1+4.65\%)/(1+2.32\%)-1 = 2.23\%$

6.   Continued

75% Index Rates
u1-10 = (1+i1-10)/(1+0.75x(u1-10))-1 = (1+3.08%)/(1+0.75x(1.33%))-1 = 2.06%
rounded to 2.10%
u10+ = (1+i10)/(1+0.75x(u10))-1 = (1+4.65%)/(1+0.75x(2.23%)-1 = 2.93%
rounded to 2.90%

Life with 15 year Guarantee:

Actuarial Equivalent Pension
Monthly
$6,875 x 16.8 = X 17.9
X = $6,452.51

Greater than ITA Limit of $5,770.83, therefore Life G15 is limited to $5,770.83
monthly

Joint and Survivor 60%:

$6,875 x 16.8 = X (16.8 + 0.6 (19.1-14.7))
X = $5,941.36

Greater than ITA Limit of $5,770.83, therefore Joint and Survivor 60% is limited
to $5,770.83 monthly

Joint and Survivor 100%:

$6,875 x 16.8 = X (16.8 + 1.0 (19.1-14.7))
X = $5,448.11 monthly
Maximum Payable form of pension under ITA limit is J&S 66-2/3%, therefore
ITA limit needs to be actuarially reduced. ITA Limit is:
$5,770.83 x (19.8 / 21.2) = $5,389.74 monthly
Greater than than ITA Limit of $5,389.74, therefore Joint and Survivor 100% is
limited to $5,389.74 monthly

(c)   Identify the most valuable optional form of payment in (b). Justify your response.

Calculate PV of normal and option forms:

Life Only = $69,250.00 x 16.8 = $1,163,400
Life G15 = $69,250.00 x 17.9 = $1,239,575
J&S 60% = $69,250.00 x 19.4 = $1,343,450
J&S 100%= $64,676.89 x 21.2 = $1,371,150

6.   **Continued**

(d)   Explain how the change in interest rates would affect the optional forms of payment

- In general, as interest rates increase, option benefit forms payable increase and as interest rate decrease, option benefit forms payable decrease.

- The magnitude of the change due to a change in interest rate varies depending on the option form elected.

- It is difficult to determine the change in interest rate impact to an annuity with guarantee because of the interrelationship between the guarantee period and age of the member due to mortality.

- In general, if the guarantee term is greater than the life expectancy of the member, as interest rates increase, the actuarial equivalence factor (Single Life / Single Life Certain) will increase, producing a larger monthly pension amount from the baseline interest rate.

- In general, for a joint and survivor election, as interest rates increase, the actuarial equivalence factor (Single Life / Joint and Survivor) will increase, producing a larger monthly pension amount. The magnitude of an increase in monthly pension is larger due to a change in interest rates is greater as the survivor percentages increases.

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

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

Learning Outcomes:
(3c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding and asset valuation methods.
(4a) Describe the principles and motivations behind pension legislation and regulation.

Sources:
Study notes FR-109-13 and FR-107-13

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Explain how MEPP funding principles could be applied to reduce the volatility of contributions to the XYZ plan.

 Commentary on Question
 A well prepared candidate would have a good understanding of the multi-employer pension plan including its funding implications. A well prepared candidate would elaborate on how volatility could be reduced by discussing the following principles of a multi-employer plan:
 - *employer funding*
 - *benefit design*
 - *assumptions and methods*
 - *investment policy*

 In order to receive full credit for this question, the candidate had to show a deep understanding of the difference in the principles between a single-employer defined benefit pension plan and a multi-employer pension plan. All points were given if the candidate was able to contrast and elaborate on the volatility issue by covering most of the points listed below. Most of the candidates were able to provide a few of the items listed (most of them discussed that benefit amount could be reduced, the use of margin or discussed the conservatism in assumptions) but most candidates did not have a broader discussion on the implications in the other areas. As a result, very few candidates were able to receive full credit on this question.

7. Continued

The area where many candidates did not do well was that they were not directly addressing the issue described in the question. They were able to show some knowledge of the basic definition of a multi-employer plan but did not relate to the question by addressing how the multi-employer principles could be used to reduce the volatility.

Employer(s) Funding
- Employers should be permitted to make tax-deductible contributions regardless of financial position (i.e., even when the plan is in a surplus)

Employers should be permitted to reduce
- future benefits
- past benefits

Maintain a high funded ratio (or avoid large unfunded liabilities)

Maintain a margin between contributions and expected plan cost

Benefit Design
Reducing benefits can be used to offset against large increases in contributions

Benefits should be designed to be predictable for all demographics*

- flat dollar benefit formula
- generous termination benefits (i.e. refund employer contributions, early vesting)
- no generous early retirement subsidies or bridges

Assumptions and methods
Find the right balance of conservatism in assumptions

Gains(losses) due to overly conservative(optimistic) assumptions lead to lower(higher) contributions (i.e. contribution variability)

Use asset smoothing to reduce the impact of market volatility

Investment Policy
Invest conservatively to avoid large losses on assets

7. Continued

(b) Explain how counter-cyclical funding regulations could help stabilize XYZ's contributions.

Commentary on Question:
A well prepared candidate would contrast and elaborate on how regulations play an important role in the volatility of a single-employer defined benefit plan contribution requirements. In order to receive full credit for this question, the candidate had to contrast and elaborate most of the guidelines listed below.

The area where many candidates did not do well was that they listed only a few items from the list below and repeated the same point in different words. In that case, no additional credit was given the same idea discussed in different words. Most candidates discussed the overfunding in a positive economic situation which allows for a buffer in a poor economic situation and discussed the possibility of using a smoothing method. However, this was not enough to receive full credit. As a result, very few candidates were able receive full credit on this question.

Counter-cyclical funding regulation guidelines

- Avoid excessive reliance on current market values of assets for determining balance sheet date funded status, and therefore contributions
- Volatility of long-term securities leads to unnecessary contribution volatility
- Set minimum funding levels/targets consistent with the goal of benefit security
- Allow appropriate overfunding during positive economic situations
- This leads to a buffer in poor economic situations
- Limit contribution holidays and sponsor access to surplus
- Encourage stability of contributions via appropriate actuarial methods
- Flexible funding rules
- Allowing an appropriate combination of smoothing/long recovery periods to fund deficits avoids significantly large contributions
- Avoid overregulation
- Constantly changing rules leads to contribution volatility

8.

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:

Morneau Shepell, Handbook of Canadian Pension and Benefit Plans, 15th edition

Canadian Pensions and Retirement Income Planning, Towers Watson, 5th edition

Commentary on Question:

In this question candidates were asked to determine the maximum pension benefits payable under the terms of the Canadian Income Tax Act (ITA) under a proposed early retirement window for a sample participant.

A well prepared candidate would have known that the calculation of the lifetime and bridge benefits payable under the early retirement window should be tested against the three limits under the ITA (maximum lifetime, maximum bridge and combined maximum).

Most candidates did very well on this question. Almost all candidates were able to first calculate the benefits (prior to application of ITA limits) that would be payable under the early retirement window; a few candidates forgot about the early retirement reduction under the plan.

Some members missed components of the maximum bridge and combined maximum tests (i.e. service pro-rate or ERF).

Solution:

Calculate the lifetime and bridge benefits payable under the early retirement window.

Show all work.

8. **Continued**

(1) ITA test: maximum lifetime benefit

Maximum lifetime benefit = min ($2,770.00 , 2% * HAE) * SVC * ERF

Where:
- HAE = 3-year highest average indexed compensation
- SVC = service
- ERF = early retirement reduction of 3% per year from the earliest of age 60, 30 years of service and 80 points

Maximum lifetime benefit = min ($2,770.00, 2% * $350,000) * 9 * (1 – 0.03 * 2) = $23,434.20

(2) ITA test: maximum bridge benefit

Maximum bridge benefit = 12 * (CPP + OAS) * min (1, SVC/10) * ERF

Where:
- CPP = maximum CPP benefit
- OAS = maximum OAS benefit
- SVC = service
- ERF = early retirement reduction of 3% per year from age 60

Maximum bridge benefit = 12 * ($1,038.33 + $551.54) * (9/10) * (1 – 0.03 * 2) = $16,140.36

(3) ITA test: combined maximum lifetime and bridge benefit

Combined maximum lifetime and bridge benefit = $2,770.00 * SVC + 25% * AYMPE * minimum (1, SVC/35)

Where:
- SVC = service
- AYMPE = 3-year average YMPE

Combined maximum lifetime and bridge benefit = $2,770.00 * 9 + 25% * $51,233.33 * (9/35) = $28,223.57

Benefit payable under the terms of the plan (including proposed bridge benefit), prior to application of limitations under the *Income Tax Act*:

Uncapped Lifetime Pension at Retirement =
2% * $325,000 * 9 * { 1 – 0.03 * (62 – 58) } = $51,480

Uncapped Bridge Pension at Retirement = 0.70% * $325,000 * 9 = $20,475

8.   **Continued**

Benefit payable under the terms of the plan (including proposed bridge benefit), <u>after</u> application of limitations under the *Income Tax Act*:

Capped Lifetime Pension at Retirement =
min ($51,480 , $23,434.20) = $23,434.20

Capped Bridge Pension at Retirement = minimum of (A) and (B) = $4,789.37, where:
(A) Minimum ($20,475, $16,140.36) = $16,140.36
(B) Maximum ($0, $28,223.57 - $23,434.20) = $4,789.37

Therefore, the member is entitled to a lifetime annual pension of $16,140.36 and an annual bridge pension of $4,789.37 from the Salaried Pension Plan.

9.

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:
(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.

Sources:
FR-114-15: Ontario Pension Benefits Act R.R.O. 1990, Reg 909

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-122-14: Pension Benefits Act–Ontario Regulation 309/13

Commentary on Question:
This question was fairly well answered. Candidates generally did very great on part b) of the question and the best candidates were able to get good marks on parts a) and c).

Solution:
(a)   List the prescribed requirements for a LOC to satisfy Ontario regulations.

Commentary on Question:
Most candidates were able to name two or three requirements here and some candidates were able to name more requirements to get full marks.

The LOC must:
- Be an irrevocable and unconditional standby letter of credit
- Be made payable to the trustee of the pension fund on demand, in trust, for the pension fund (i.e. cannot be made payable to the employer)
- Have an effective date that is on or before the date the first special payment is due
- Have an expiry date no later than one year after its effective date
- Aggregate of all LOCs cannot exceed 15% of the plan's solvency liabilities
- Cannot be amended except as permitted by regulations
- Must be payable in Canadian currency

9. Continued

- Must be issued by a prescribed issuer such as a bank or credit union that meets certain agreements
- Must be held under a trust agreement
- It must make the issuer contractually liable to pay out money under its terms of payment if demanded it by the trustee

(b) ABC has decided to obtain a LOC in order to minimize special payments in 2015.

Commentary on Question:
Most candidates were able to calculate the annual amount of special payment including the new amortization payment. The best candidates also thought about checking the limit that can be covered by the LOC.

1. Determine the new solvency amortization payments:
Factor to amortize = a4⁻| compounded monthly (a4⁻| at 2.7% p.a., compounded monthly)
= [1-(1.027^(1/12))^-48] / [1.027^(1/12)-1]/12 = 3.7900
Present value of Existing Payment = annual amount * factor to amortize
= 30,000 * 3.79 = 113,700

New Solvency Deficiency to Amortize = Solvency Deficit – PV of Existing Payment
= 288,000 – 113,700 = 174,300

Factor to amortize = a5⁻| compounded mthly (a5⁻| at 2.7% p.a., compounded monthly)
= [1-(1.027^(1/12))^-60] / [1.027^(1/12)-1]/12 = 4.6761

Annual Amount of new Payment = new solvency deficiency to amortize / factor to amortize
= 174,300 / 4.6761 = 37,275

2. Determine the solvency special payments to be covered by the Letter of Credit:
Minimum LOC = Existing Solvency Special Payments + New Solvency Special Payments
= 30,000 + 37,275 = 67,275
3. Confirm that the face value of the LOC is not capped by the maximum LOC allowable:
Maximum LOC = 15% x solvency liabilities
= 15% x 1,257,000 = 188,550
4. Confirm the amount of LOC required to secure minimum special payments that would otherwise be required to be made to the pension fund during 2015: $67,275.

9. Continued

(c) Describe the advantages and disadvantages of using a LOC to cover special payments.

Commentary on Question:
This part of the question seemed more difficult for the candidates. Most candidates were able to receive some points from the advantages but, in general, didn't receive all the points for the disadvantages.

The following are advantages of using LOC to cover special payments:
- Do not have to contribute solvency special payments into the plan
- Allows better cash flow management
- Frees up capital that can be invested in the business
- Reduces risk of developing trapped surplus in future (especially since plan is already in going concern surplus)
- Provides certain level of benefit security without having to make the full solvency special payments into the plan
- Can be included in the solvency special payment calculations as asset

The following are disadvantages of using LOC to cover special payments:
- The LOC takes up credit capacity for ABC
- LOC is not included in transfer ratio
- LOC is not included in PBGF assessment calculation
- LOC is not used in determining frequency of valuations (annual versus triennial)
- LOC is not included in going concern assets
- LOC is not included in assets for accounting purposes
- There is additional interest payable on portion of the solvency special payments covered by the LOC
- Fees and expenses related to obtaining, holding, amending or cancelling the LOC cannot be paid from the pension fund creating additional costs for ABC
- Payments to the issuer to secure LOC could have been used for funding the plan instead (creates additional cost for securing LOC)

10. 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:

Guidance on Asset Valuation Methods, CIA Educational Note, November 2007

Educational Note – Guidance on Asset Valuation Method

Standards of Practice – 3000

ASOP No. 44

Commentary on Question:

The question was testing if the candidate can tie the desirable characteristics of an asset smoothing method to the proposed asset valuation method. No points were awarded for just listing the desirable characteristics and numerous candidates just listed them without providing a critique.

Most candidates were able to identify that the proposed asset valuation method is not consistent with the length of a typical economic cycle and that the asymmetrical corridor around the market value creates a bias.

A successful candidate would have properly identified at least 4 of the violations listed below for the proposed asset valuation method.

Candidates who did not do well on this question either argued the opposite to some of the points in the solution below, omitted some of the points and/or did not provide an explanation of how a desirable characteristic is tied to the proposed method.

Solution:

Critique the proposed asset valuation method, taking into consideration the Canadian Institute of Actuaries' guidance on asset valuation methods.

<u>Achieve Objective</u>

Deferral of gains and losses recognition can moderate the volatility of contribution rates but the selected method should be appropriate for the purpose and circumstances of the work.

10. Continued

Tracks to market value.
Smoothing of unrealized gains and losses over 8 years will have gains and losses from a long period of time not reflected in the smoothed asset value. It is unlikely to have the smoothed asset value to return to the market value in a reasonable period.

The asset valuation method does not unduly deviate from market value.
The proposed asset valuation method deviates excessively from market value (i.e. 125% of market value).

Has a reasonable and logical relationship to market value
The asymmetrical corridor and the extended long smoothing period could produce a smoothed asset value that is not reasonable to the market value.

It is generally free of any bias.
The proposed asset valuation method has systematic bias due to asymmetrical corridor around the market value that is in favor of a higher smoothed value of assets

Should not influence investment decisions.
The proposed asset valuation method smoothes unrealized gains and losses only and significant changes to asset turnover could cause a significant change in the smoothed asset value.

It is consistent with the length of typical economic cycles.
The smoothing period of 8 years is beyond a typical length of an economic cycle. May create intergenerational transfers of wealth.

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

Learning Outcomes:
(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.

Sources:
Towers, Chapter 9,10

Commentary on Question:
In general, candidates answered the question reasonably well. However, many candidates did not correctly pro-rate the PA offset for part A. Also, the majority of the candidates did not know how to calculate a PA for a SOMEPP for part B.

Solution:
(a) Calculate the member's 2014 Pension Adjustments.

   Show all work.

   benefit earned in association A = $55 x 6 = $330
   PA A = $330 x 9 – 600 x (6/12) = $2,670
   Benefit earned in association B = $47 x 4 = $188
   PA B = $188 x 9 – 600 x (4/12) = $1,492
   Total PA = PA A + PA B = $4,162

(b) Calculate the member's 2014 Pension Adjustments, assuming the ABC plan is a Specified Multi-Employer Pension Plan.

   Show all work.

   As SMEP, PA calculated like a DC plan:
   PA A = EE + ER contribution = $1,200 + $1,200 = $2,400
   PA B = EE + ER contribution = $600 + $600 = $1,200
   Total PA = PA A + PA B = $3,600

(c) List the criteria to be exempt from the PSPA certification process.

   The administrator must prove to the CRA the past service improvement meets the given criteria:
   a. Plan must have at least 10 active members who are earning benefits under the plan

11. Continued

      b. In the case of a benefit improvement, substantially all of the active members who are earning benefits under the plan's DB provision are receiving the improvement
      c. The improvements in benefits are not more advantageous for inactive members than for active members
      d. No more than 25% of the active members affected by the improvements are "specified active members" – i.e. those who are "connected persons" or who are expected to earn more than 2.5 times the YMPE in the year of improvement
      e. Improvements are note provided disproportionately to "specified active members"

(d)   Describe in words the considerations in calculating the member's PSPA.

Need to calculate new PA for municipality B:
PSPA formula = A – B – C + D, where A is recalculated PAs, B is sum of pension credits, C is the amount of any qualifying transfer, D is the amount of any excess money purchase transfer.

The benefit exclusions when calculating a PSPA should also be taken into account, in particular:

Exclusion i) increasing the "base year" by the average wage

Exclusion ii) increasing the benefit rate prior to the increase by $1.50 per month times the number of years on which the current rate was first effective to the day of the increase.

12. **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 unfunded accrued liability and normal cost using the Projected Unit Credit, prorated on service, cost method. They will also be calculate and reconcile the gain/loss resulting from various experience items and be able to identify the sources of change in the normal cost from one valuation to the next.

Solution:
(a)   Calculate the normal cost and the unfunded actuarial liability as at December 31, 2014.

Commentary on Question:
Overall, candidates performed relatively well on this part of the question. Some candidates had minor arithmetic errors. There were also some candidates who did not correctly reflect the retirement and termination decrements in the calculations.

PUC $AL_x = \sum q_y \times l_y \times B_y \times \ddot{a}_y^{(12)} \times v^{(y-x)} \times [(x-w) \div (y-w)]$; x – age; y-rtmt age;
$+ \sum q_t \times l_t \times B_t \times \ddot{a}_{65}^{(12)} \times v^{(65-x)} \times [(x-w) \div (t-w)]$; t-term age; w-hire age

UC $NC_x = \sum q_y \times l_y \times B_y \times \ddot{a}_y^{(12)} \times v^{(y-x)} \times [1 \div (y-w)] + \sum q_t \times l_t \times B_t \times \ddot{a}_{65}^{(12)} \times v^{(65-x)} \times [1 \div (t-w)]$

Member A
AL $= 50\% \times [1 - 10\%] \times 50,000 \times 1.03^{30} \times 1\% \times 4 \times 13.9 \times v^{30}$
        $+ [1 - 50\%] \times [1 - 10\%] \times 50,000 \times 1.03^{35} \times 1\% \times 4 \times 12.5 \times v^{35}$
        $+ 10\% \times 50,000 \times 1\% \times 4 \times 12.5 \times v^{35}$
        $= 7,026 + 5,739 + 453$
        $= 13,218$
NC $= 13,218 \div 4$
        $= 3,304$

12. Continued

Member B
$$AL = 50\% \times 100{,}000 \times 1.03^{10} \times 1\% \times 10 \times 13.9 \times v^{10}$$
$$+ [1 - 50\%] \times 100{,}000 \times 1.03^{15} \times 1\% \times 10 \times 12.5 \times v^{15}$$
$$= 57{,}341 + 46{,}838$$
$$= 104{,}179$$
$$NC = 104{,}179 \div 10$$
$$= 10{,}418$$

$$AL_{2014} = 117{,}397$$

$$NC_{2014} = 13{,}722$$

$$UAL_{2014} = AL - F$$
$$= 117{,}397 - 120{,}000 = (2{,}603)$$

(b)   Calculate the unfunded actuarial liability as at December 31, 2015.

Commentary on Question:
Overall, candidates performed quite well on this part of the question.

Member A
$$AL = 50\% \times 50{,}000 \times 1.05 \times 1.03^{29} \times 1\% \times 5 \times 13.9 \times v^{29}$$
$$+ [1 - 50\%] \times 50{,}000 \times 1.05 \times 1.03^{34} \times 1\% \times 5 \times 12.5 \times v^{34}$$
$$= 10{,}445 + 8{,}532$$
$$= 18{,}977$$

Member B
$$AL = 100{,}000 \times 1\% \times 10 \times 12.5 \times v^{14}$$
$$= 63{,}133$$

$$AL_{2015} = 82{,}110$$

$$F_{2015} = (120{,}000 + 3{,}304) \times 1.1$$
$$= 135{,}634$$

$$UAL_{2015} = AL - F$$
$$= 82{,}110 - 135{,}634 = (53{,}524)$$

(c)   Calculate the gains and losses by source for 2015.

Show all work.

12. Continued

Commentary on Question:
Many candidates were able to identify and calculate most of the sources of gain and loss. However, a number of candidates missed some sources of gain/loss (especially the termination loss for Member A) and/or failed to check that these reconciled with the change in the unfunded accrued liability.

Exp'd UAL $= (2,603) \times 1.05 = (2,733)$
Gains/(Losses) $= (2,733) - (53,524) = 50,791$

Gain on fund return:
Exp'd F_{2014} $= (120,000 + 3,304) \times 1.05$
$= 129,469$
Gain $= 135,634 - 129,469 = 6,165$

Loss on termination – Member A:
AL_{2015} (exp sal incr) $= AL_{2015} \times 1.03 \div 1.05$
$= 18,615$
Exp'd AL_{2015} $= (13,218 + 3,304) \times 1.05$
$= 17,348$
Loss $= 18,615 - 17,349$
$= 1,267$

Gain on termination – Member B:
Exp'd AL_{2015} $= 104,179 \times 1.05$
$= 109,388$
Gain $= 109,388 - 63,133$
$= 46,255$

Loss on salary increase for A:
AL_{2015} (exp sal incr) $= 18,615$
Loss $= 18,977 - 18,615$
$= 362$

Check:
Gains/(Losses) $= 6,165 - 1,267 + 46,255 - 362$
$= 50,791$