RET FRC Model Solutions
Spring 2018

1. **Learning Objectives:**

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

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

Learning Outcomes:

(2c) Evaluate actual experience, including comparisons to assumptions.

(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

Pension Mathematics for Actuaries, Anderson, 3rd Edition, Ch. 5

Commentary on Question:

Candidate will understand how to perform valuations of ongoing plans, calculating normal cost and actuarial liability, using projected unit credit method; and be able to evaluate actual experience, including comparisons to assumptions (i.e., gain and loss analyses). Candidates who did well on this question generally did well on all three parts.

Solution:

(a) Calculate the accrued liability and normal cost at December 31, 2017 for each member. Show all work.

Commentary on Question:

Candidates who were not awarded full credit did not take into account the cumulative effect of the various decrements

1. Continued

Member A
AL at Dec. 31, 2017 = AL (term 50) + AL (ret 55) + AL (ret 62) + AL (ret 65) = **$162,135**

AL (term 50) = 0.10 x 2% x $80,000 x 10 x 13.3 x $(1.05)^{-(65-50)}$ = $10,236
AL (ret 55) = 0.90 x 0.25 x 2% x $80,000 x $(1.03)^{(55-50)}$ x 10 x 15.8 x $(1.05)^{-(55-50)}$ x [1 - 0.04 x (62 - 55)] = $37,199
AL (ret 62) = 0.90 x 0.75 x 0.5 x 2% x $80,000 x $(1.03)^{(62-50)}$ x 10 x 14.2 x $(1.05)^{-(62-50)}$ = $60,878
AL (ret 65) = 0.90 x 0.75 x 0.5 x 2% x $80,000 x $(1.03)^{(65-50)}$ x 10 x 13.3 x $(1.05)^{-(65-50)}$ = $53,823

NC at Dec. 31, 2017 = NC (term 50) + NC (ret 55) + NC (ret 62) + NC (ret 65) = **$15,190**

NC (term 50) = $0
NC (ret 55) = 0.90 x 0.25 x 2% x $80,000 x $(1.03)^{(55-50)}$ x 1 x 15.8 x $(1.05)^{-(55-50)}$ x [1 - 0.04 x (62 - 55)] = $3,720
NC (ret 62) = 0.90 x 0.75 x 0.5 x 2% x $80,000 x $(1.03)^{(62-50)}$ x 1 x 14.2 x $(1.05)^{-(62-50)}$ = $6,088
NC (ret 65) = 0.90 x 0.75 x 0.5 x 2% x $80,000 x $(1.03)^{(65-50)}$ x 1 x 13.3 x $(1.05)^{-(65-50)}$ = $5,382

Member B
AL at Dec. 31, 2017 = AL (ret 62) + AL (ret 65) = **$367,427**

AL (ret 62) = 0.5 x 2% x $(1.03)^{(62-61)}$ x $100,000 x 14 x 14.2 x $(1.05)^{-(62-61)}$ = $195,013
AL (ret 65) = 0.5 x 2% x $100,000 x $(1.03)^{(65-61)}$ x 14 x 13.3 x $(1.05)^{-(65-61)}$ = $172,414

NC at Dec. 31, 2017 = NC (ret 62) + NC (ret 65) = **$26,245**

NC (ret 62) = 0.5 x 2% x $(1.03)^{(62-61)}$ x $100,000 x 1 x 14.2 x $(1.05)^{-(62-61)}$ = $13,930
NC (ret 65) = 0.5 x 2% x $100,000 x $(1.03)^{(65-61)}$ x 1 x 13.3 x $(1.05)^{-(65-61)}$ = $12,315

Alternate solution: Since there is no assumed decrement in the beginning of the first year, then use the formula AL at Dec. 31, 2017 / Credited Service at Dec. 31, 2017 = $367,427 / 14 = **$26,245**

(b) Calculate the accrued liability at December 31, 2018 for each member. Show all work.

1. Continued

Commentary on Question:
Candidates who did well on part (a) generally did well on part (b).

Member A (Age 51)
Earning 2018 = $80,000 * 1.07 = $85,600

AL at Dec. 31, 2018 =AL (ret 55) + AL (ret 62) + AL (ret 65) = **$202,508**

AL (ret 55) = $0.25x2\% \times \$85,600 \times (1.03)^{(55-51)} \times 11 \times 15.8 \times (1.05)^{-(55-51)} \times [1- 0.04 \times (62-55)] = \$49,593$
AL (ret 62) = $0.75 \times 0.5 \times 2\% \times \$85,600 \times (1.03)^{(62-51)} \times 11 \times 14.2 \times (1.05)^{-(62-51)} = \$81,160$
AL (ret 65) = $0.75 \times 0.5 \times 2\% \times \$85,600 \times (1.03)^{(65-51)} \times 11 \times 13.3 \times (1.05)^{-(65-51)} = \$71,755$

Member B (Age 62)
Earning 2018 = $100,000 * 1.03 = 103,000

AL at Dec. 31, 2018 (death benefit) = $2\% \times \$103,000 \times 15 \times 13.3 \times (1.05)^{-(65-62)} = \$355,011$

(c) Calculate the gains and losses by source for 2018.
Show all work.

Commentary on Question:
Candidates were awarded full credit if they listed, calculated and reconciled each source of gain/loss correctly for each member.

1. Continued

Member A

Source	Amount	Notes
AL Dec. 31, 2017	$162,135	Part (a)
NC Dec. 31, 2017	$15,190	Part (a)
Interest	$8,866	(162,135 + 15,190) * 0.05
Expected liability at December 31, 2018	$187,266	Sum of the above
Actual liability at December 31, 2018	$186,191	Part (b)
Net loss (gain)	**$16,317**	**$202,508 - $186,191 = Actual AL – Expected AL**
Termination loss (gain)	$8,747	Actual liability at end of 2018 (which reflects survival in 2018) with expected salary less expected liability = $202,508 / 1.07 * 1.03 – ($162,135 + $15,190 + $8,866)
Salary loss (gain)	$7,570	$202,508 / 1.07 * (0.07-0.03)
Total net loss (gain)	**$16,317**	$8,747 + $7,570 = $16,317

Termination loss = **$8,747**
Salary loss = **$7,570**
Net loss (gain) = Termination loss + Salary loss = $8,747 + $7,570 = $16,317

1. Continued

Member B

Source	Amount	Notes
AL Dec 31, 2017	367,427	Part (a)
NC Dec. 31, 2017	26,245	Part (a)
Interest	19,684	(367,427 + 26,245) * 0.05
Expected liability at December 31, 2018	$413,356	Sum of the above
Actual liability at December 31, 2018	$355,011	Part (b)
Net loss (gain)	**($58,345)**	**$355,011- $413,356 = Actual AL – Expected AL**
Mortality loss (gain)	($58,344)	Expected liability incurred = $0 Expected liability released = $0 Actual liability incurred = $355,011 Actual liability released = $367,427+$26,245 + $19,684 = $413,356

Mortality loss (gain) = ($58,344)
Net loss (gain) = Mortality loss (gain) = ($58,344) (rounding diff)

2. Learning Objectives:

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

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

Learning Outcomes:

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

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

Sources:

Selection of mortality assumptions for pension plan actuarial valuations (CIA), ASOP25 and ASOP 35, Selecting and Documenting Mortality Assumption – AAA, CIA Consolidated Standards of Practice - Pension Plans 3100-3500 ,Effective June 9, 2015

Commentary on Question:

The question asked candidates to describe the considerations in setting the mortality assumptions. Many candidates said that adjustments needed to be made due to collar type, pension size, etc., but failed to describe how the adjustment would be made for each plan. It was important for candidates to recognize that the considerations were different for each plan due to membership size. Very few candidates described considerations for how to adjust a standard mortality table.

Solution:

Describe how you would set the going concern post-retirement mortality assumption for the January 1, 2018 funding valuation of each plan.

General Comments

The two components of the selection of an appropriate best estimate mortality assumption are:

- The best estimate of the current rates of mortality for the plan; and
- Appropriate adjustments for future improvements in mortality.

1. Best estimate current rates of mortality

Plan A (Banking Industry) & Plan B (Mining Industry)

- For Plan A:
  - Number of retirees is insufficient to conduct a credible mortality experience study (small plan, 100+; Midsize, 1000+)
  - Consider selecting a base mortality table for private sector (e.g., CPM2014 private as opposed to CPM2014 combined)

2. Continued

  - Consider adjusting the base mortality table to reflect white collar or using size adjustments, as pensioners and deferred vested have large annual pensions. In general, larger pensions are correlated with longer life expectancy than general pensioner population.
- For Plan B:
  - Number of retirees is insufficient to conduct a credible mortality experience study (small plan, 100+; Midsize, 1000+)
  - Consider selecting a base mortality table for private sector (e.g., CPM2014 private as opposed to CPM2014 combined)
  - May adjust mortality table using size adjustments for blue collar or using size adjustments as pensioners and deferred vesteds have smaller pensions. In general, smaller pensions are correlated with shorter life expectancy than general pensioner population.
- For Plans A and B:
  - Even though the number of retirees is insufficient to conduct a credible mortality experience study, should examine experience gain/loss related to pensioner mortality arising from past actuarial valuations
  - Consider adjusting the base mortality table if experience shows sub-standard or super-standard mortality, being mindful of credibility of data

<u>Plan C (Education Industry)</u>

- Consider selecting a base mortality table for the public sector (e.g., CPM2014 public as opposed to CPM2014 combined)
- Consider adjusting the base mortality table to reflect super-standard mortality. While there are currently only 50 pensioners, this is an outcome of the recent annuity buy-out of approximately 10,000 pensioners. Further,
  - the previously completed multiple experience studies showed that Plan C has super-standard mortality would have been based on a volume of data would have some degree of credibility (more credible than Plans A and B); and
  - The recently completed annuity buy-out also saw the pricing of the annuity purchase being much higher than other annuity purchases of similar size and plan provisions, which also support super-standard mortality.

Plans A, B, and C presumably have a post-retirement assumption in place for going concern funding valuation purposes. In general, when should you consider changing a Mortality Table?

- When assessing whether to change a valuation mortality table based on the results of an experience study, begin by comparing the observed deaths weighted by benefit amount to the expected deaths weighted by benefit amount.

2. Continued

- If the current mortality table is a good representation of the actual underlying mortality rates of plan members and former members, the ratios of actual to expected deaths should closely track 1
- Consider the characteristics of plan members and former member:
  o Collar type (higher rates of mortality for blue collar vs. white collar)
  o Industry (higher rates of mortality for private sector vs. public sector)
  o Pension size (higher rates of mortality for pensioners receiving smaller pensions)
- Use caution when deriving adjustments for variations in more than one plan characteristic at the same time, as the combined effect may overstate or understate the actual relationship – should instead look at characteristic separately

2. Appropriate adjustments for future improvements in mortality

- Development of a best estimate of future mortality improvement rates typically comprises three elements:
  - short-term rate based on recently observed improvement rates
  - ultimate long-term improvement rate, which is highly uncertain; and
  - a transition from the short-term to the ultimate improvement rates that vary by year and age.

There are three common methods of providing adjustments for future improvements in mortality:

- 2-D generational mortality tables,
- 1-D generational mortality tables,
- static mortality tables with fixed projection period

Specific to Plans A, B, and C

- Analysis of improvement rates requires large quantities of consistent data over long periods,
- Most mortality improvement studies based on data gathered through social security programs
- Insufficient data in these plans to develop improvement assumption – should use standard improvement assumption

3. 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:

(5d) The candidate will be able to describe and apply regulation pertaining to plan termination/wind-up.

(5e) The candidate will be able to describe and apply regulation pertaining to plan conversion.

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

(6b) Evaluate funding restrictions imposed by regulations.

Sources:

FR-114-18: 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)

FR117-15: FSCO overview and Q&A on Letters of Credit

FR118-15: FSCO overview and Q&A on Letters of Credit – FAQs

FR112-16: Filing Requirements and Procedure on Full or Partial Wind up of a Pension Plan

FSCO policy on conversion of a plan from defined benefit to defined contribution

Commentary on Question:

Candidates were encouraged to provide answers that moved beyond simply writing down lists and to provide answers in the context of the information provided in the question. Full marks were provided for answers that provided sufficient information on all five of the regulatory considerations. Candidates that described the implications of letters of credit scored well on the question.

3. Continued

Solution:
Describe the regulatory considerations for options (a) and (b) with respect to each of the following:

(i) Communication to members
(ii) Regulatory reporting
(iii) Tax implications for members
(iv) Impact on benefits
(v) Funding implications

Commentary on Question for option (a):
Successful candidates were able to identify key considerations from the five regulatory considerations. Some candidates described the general features of defined benefit and defined contribution plans, and were not awarded any marks for their work.

(i) Communication to members:

- Plan sponsor has fiduciary obligation to ensure that members understand implications of conversion and the options available to them
- A notice must be remitted to all affected members
- The statement of benefits and options have requirements as per provincial legislation:
    - choice to retain DB
    - commuted value if converts (including ancillary benefits and any improvements)
    - explanations as to the pension the member would receive from DC plan (purchasing annuity upon termination)
    - non-eligible ancillary benefits; and
    - vesting rule that still applies.

(ii) Regulatory reporting:

- A notice must be remitted to the Superintendent
- A conversion report is required outlining impact on plan's funded status and future contribution requirements, and must be filed with regulator
- An amendment needs to be registered with the regulator. The effective date of amendment may not be earlier than the date of the notice.
- The administrator must continue to file Annual Information Returns

3. Continued

(iii) Tax Implications for members:

- The transfer value over the Maximum Transfer Limit prescribed by the ITA must be paid cash to the member
- The conversion to DC may create a Pension Adjustment Reversal (PAR)

(iv) Impact on Benefits:

- Plan members cannot be forced to convert accrued benefits, and must be given choice to convert. If no choice is made, considered as if elected not to convert
- The commuted value must be calculated in accordance with the Regulation and reflect any bridge or early retirement benefits for which the member has met the eligibility requirements.

- The commuted value must contain reasonable salary projection if plan formula related to earnings. The commuted value may contain a probability of termination.
- Sponsor can purchase annuities, but must comply with legislation for the early retirement commencement, the transfer of the commuted value and pre-retirement death benefits

(v) Funding implications:

- The plan sponsor must contribute any shortfall of the conversion in a lump sum (as letter of credit not counted towards determination of solvency assets)
- The plan sponsor must also make lump sum payment to ensure the solvency ratio of the remaining members in the DB provision is not reduced by the conversion
- The Pension Benefits Guarantee Fund will still apply to the deferred pension but not to the DC benefits.
- Can reduce face value of letter of credit if:
    - if the employer has paid into the pension fund the amount by which the letter of credit is to be reduced; or
    - if valuation report indicates that the solvency liabilities minus the solvency assets is less than or equal to the present value of the total amounts of all letters of credit, then the letter of credit may be reduced to the level by which the solvency liabilities exceed the solvency assets.
- If reducing face value of letter of credit, trustee of letter of credit must be notified.

Commentary on Question for option (b):
Successful candidates were able to identify key considerations from the five regulatory considerations. In particular, addressing the impact of the company's use of a letter of credit was critical for the scoring adequate marks in this section.

3. Continued

(i) Communication to members:

- A wind-up notice must be remitted to all members, former members and persons entitled to benefits and the Superintendent. Effective date of the wind up cannot be earlier than date notice is given to members
- Benefit statements must be remitted to members within 60 days of report approval by FSCO

(ii) Regulatory reporting:

- A wind up report must be submitted to FSCO. Wind up report must consider early retirement options, joint and 60% survivor option, full vesting, minimum credited interest.
- The wind up report must be prepared in accordance with the Act, the regulation and the CIA Standards. The wind up report sets out:
    - the assets and liabilities;
    - the benefits to be provided to members, former members, retired members and other persons;
    - the methods of allocating and distributing the assets and determining the priorities for payment of benefits
    - Membership data is required by FSCO to make their review including the accrued benefits and the commuted value
    - Must consider early retirement options, joint and 60% survivor option, minimum credited interest.
- The pension plan administrator must notify the trustee of the letter of credit that the employer intends to wind-up the pension plan
- Amendment, Resolutions, Form 1.1 and Superintendent's Checklist must be submitted to FSCO
- Annual Information Return, including PBGF, and Financial Statements must be filed within 6 months following the wind up date
- If plan's financial position is in deficit, the administrator is required to file a report annually until the employer's obligation has been fulfilled
- Within 30 days after the final distribution of assets, the administrator must give written notice to Superintendent that all assets of the plan have been distributed

(iii) Tax Implications for members:

- Contributions to RRSP are considered salary under the *ITA*, thus payroll taxes apply
- Contributions can't exceed member's contribution limit as defined by the Income Tax Act and Regulations

3. Continued

(iv) Impact on Benefits:

- No payments must be done unless already in payment on the date of the wind up
- Members must make an election within 90 days. If no election is made, will consider immediate pension if eligible, otherwise deferred pension to earliest date
- Must consider grow-in benefits
- Employer needs to set up Group RRSP with an insurer or a trustee
- Group RRSP where members have investment choice are subject to CAP Guidelines

(v) Funding implications:

- Plan sponsor has 60 days to make payment after the later of reception of member's choice or report approval by FSCO
- As a minimum, the deficit (excluding face value of letter of credit) must be funded by annual special payments over a maximum period of 5 years commencing on the effective date of the wind up
- If the employer is subject to bankruptcy proceedings, the trustee of the letter of credit must submit a demand for payment from the insurer of the letter of credit

4. Learning Objectives:

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

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

Learning Outcomes:

(2b) Evaluate and recommend appropriate assumptions for funding purposes.

(7b) Explain and apply the Professional Conduct Guidelines.

(7c) Explain and apply relevant qualification standards.

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

(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 Professional Conduct Guidelines.

Sources:

CIA Rules of Professional Conduct

ASOP 27 – Selection of Economic Assumptions for Measuring Pension Obligations

Commentary on Question:

The question was intended to test candidates' knowledge of factors that should be considered in developing actuarial assumptions. This was done in the context of a client situation where the Company proposed a set of actuarial assumptions, and the candidates were asked to critique the proposed assumptions and propose their own

Solution:

(a) Critique the Company's proposed assumptions, taking into account professional standards.

Commentary on Question:

Most candidates were able to recognize that the Company's proposed assumptions were inappropriate. However, in order to gain any marks, the candidate had to provide justification for why the assumption was inappropriate. Broad statements simply stating that the assumption is "unreasonable" were not enough. Candidates were also expected to apply professional standards in their critique, which many did not.

4. Continued

Of the candidates who mentioned the professional standards, many simply stated them without linking them to the critique of the specific proposed assumptions.

Note that in some cases, differing answers were deemed acceptable as long as candidates provided appropriate justification for their critique. For example, it was appropriate to agree with the Company's proposal of no termination scale on the basis of immateriality or disagree with the removal of the termination scale.

In addition to applying professional standards, a complete analysis would have recognized that plan-specific factors (i.e., early retirement provisions/subsidies, management's expectation of salary increases in the short-term, actuarially equivalent benefit on termination, etc.) should be considered.

The following is a comprehensive list of the possible critiques/comments that would've received marks.

The professional standards that apply to this situation are:

i) Rule 1 - Professional integrity. The actuary is to act in a manner to fulfil the actuary's professional responsibility to the public and uphold the reputation of the profession.

ii) Rule 3 - Standards of Practice. The actuary is required to observe applicable standards of practice that have been promulgated by the CIA when rendering professional services.

iii) Rule 6 - Control of work product. The actuary is to take reasonable steps to ensure that services are not used to mislead other parties or to violate or evade the law.

iv) should conform to accepted actuarial practice

In general assumptions should:

- be appropriate in aggregate and also independently reasonable unless the selection of assumptions that are not independently reasonable can be justified.
- reflect the actuary's professional judgment.
- take into account historical and current data that is relevant as of the measurement date but would not necessarily have to reflect current conditions persisting into the future.
- reflect the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof.

4. Continued

- no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed.

Specific Critiques of Each Individual Assumption:

SALARY SCALE

- may be appropriate to recognize the budgeted salary increases over a short period of time if this reflects future compensation practice.
- gain/loss results on salary increases less than expected from recent valuations may provide evidence for change in assumption.
- not appropriate to assume zero salary increases over the long term.
- not appropriate to have long term salary assumption below the long term inflation assumption.
- Company's proposed assumption would contravene Rule 3 since the assumption would not be "reasonable".
- Rule 1 would be violated if the actuary makes inappropriate changes based on the Company's request.
- Rule 6 would be violated by a salary increase assumption lower than an appropriate will result in contributions lower than appropriate.

INFLATION

- the data used to develop inflation should include the consumer price indices, the implicit price deflator, forecasts of inflation, etc.
- not appropriate to base long term assumption exclusively on recent experience.
- a long term inflation rate of 0.50% not appropriate given the Bank of Canada's target rate is between 1.0% and 3.0%
- Company's proposed assumption would contravene Rule 3 since the assumption would not be "reasonable".
- Rule 1 would be violated if the actuary makes inappropriate changes based on the Company's request.

4. Continued

RETIREMENT SCALE

- may be appropriate to modify retirement age assumption to reflect recent experience if it is expected to continue in future years.
- May not be appropriate to change to a retirement age of 65 when members are entitled to unreduced pension at 62 with a bridge benefit
- Company's proposed assumption would contravene Rule 3 since the assumption would not be "reasonable".
- Rule 6 would be violated by an inappropriate retirement age assumption as it may understate the liabilities.

TERMINATION SCALE

- gain/loss results on termination experience from recent valuations may provide evidence for change in assumption, but not elimination of termination scale altogether.
- since termination benefit is either deferred pension or lump sum equal to actuarial present value of accrued pension at 65, termination assumption will not affect liabilities materially.
- reasonable to argue for a simplified assumption of zero terminations.

(b) Recommend revised assumptions given the Company's recent experience and professional standards.

Justify your recommendations.

Commentary on Question:
Candidates were expected to provide a clear recommendation for each of the assumptions, but more importantly, justify their proposed assumption in light of the Company's recent experience and professional standards.

In some cases, candidates broadly discussed different possible options for the assumptions without giving a clear recommendation or justification. In cases where a specific recommendation was given, no marks were awarded if justification was not provided.

Note that any reasonable recommendation was accepted, as long as justification was provided. There is not any "right" or "wrong" answer in general, and the lists that follow are examples of what was deemed acceptable.

4. Continued

SALARY SCALE

- Recommendation:
  - Salary increase of 2.0% for an initial period and an ultimate rate of 3.5% where the initial period is 1 to 3 years depending o professional judgement on how likely actual increases will be held to budget
- Justification:
  - recognize the short term budget assumption of 2.0% and revert to long-term assumption following initial period
  - for long-term, consider building block approach of inflation plus productivity plus merit and promotion component

INFLATION

- Recommendation:
  - recommend that assumption remains at 2.0%

- Justification:
  - a long term inflation rate of 0.50% not appropriate given the Bank of Canada's target rate is 2.0% and the target range is 1.0% to 3.0%
  - short term historical inflation is not an appropriate indicator of long term inflation rate
  - although assumption does not have any direct impact on the funding of the pension plan, it is generally used in conjunction with the selection of a salary scale assumption

RETIREMENT SCALE

- Recommendation:
  - recommend a higher initial retirement age (e.g. 58 or 60) or a lower percentage than 50% at age 55
- Justification :
  - must recognize that the plan provides an unreduced benefit at age 62 and a bridge benefit
  - should continue to assume that the other actives retire at 62 or attained age if older
  - should review plan retirement study not just Company's comment that members are retiring later than expected
  - gain/loss on retirement experience from recent valuations will provide information on whether or not assumption should be reviewed

4. Continued

TERMINATION SCALE

- Recommendation:
  - recommend that current assumption be maintained

- Justification:
  - current assumption is based standard termination table, it is not based on plan experience since plan experience is not credible
  - since termination assumption will not affect liabilities materially no reason to make change
  - assumption is reasonable

5. Learning Objectives:

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

Learning Outcomes:

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

(6b) Evaluate funding restrictions imposed by regulations.

Sources:

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

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

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

Commentary on Question:

Calculation question- Candidates generally did well if they understand the funding rules.

Solution:

(a) Calculate the stabilization provision percentage for each plan as at December 31, 2017.

Show all work.

Salaried Plan

Duration of plan assets =40% fixed income * 15 years duration = 6 years of duration for assets

Asset duration / liability duration = 6 years / 15 years = 0.4

Use line for 60% variable income securities and interpolate for columns

= 17 – (40-25)/(50-25)*2 = 15.8

Stabilization provision is 15.8% for salaried plan

5. Continued

Hourly Plan
Determine duration of plan assets

=25% fixed income * 9 years duration = 2.25 years of duration for assets

Asset duration / liability duration = 2.25 years / 18 years = 0.125

Need to interpolate between lines and columns

= 50% * (22+ 20)/2 + 50% * (24 + 22) /2= 0.22

Stabilization provision is 22.0% for hourly plan

(b) Calculate the 2018 minimum funding requirements for each plan.

Show all work.

Salaried plan
Service cost contribution to remit is $1M * (1+ stabilization provision) = $1M *1.158 = $1.158 M

Deficit at [target stabilization provision – 5%] =
1.108 * $16,000,000 - $15,000,000 = $2,728,000.

This needs to be amortized over 13 years

Factor is 9.65 (monthly factor payable immediately)
Amortization =$2,728,000/9.65 = $282,694

Minimum 2018 contributions = CSC contribution + amortization = $1,158,000 + $282,694 = $1,440,694

Hourly plan
Service cost contribution to remit is $2M * (1+ stabilization provision) = $2M *1.220 = $2.44 M

Deficit at [target stabilization provision – 5%] =
1.170 * $47,000,000 - $55,000,000 = -$10,000.

No amortization required given small excess over target.

Minimum 2018 contributions = CSC contribution + amortization = $2.44 million

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:

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

Candidates received full credit where they used " $\ddot{a}_{61}^{(12)} - {}_{4}|\ddot{a}_{61}^{(12)}$ *" in place of* $\ddot{a}_{61:\overline{4}|}^{(12)}$ *in any of the calculations.*

Solution:

(a) Calculate the monthly early retirement pension payable under the normal form of payment as at January 1, 2017.

Show all work.

Annual Plan Benefit = 2% x FAE x Credited Service x ERF

Age + Service = 61 + 25 = 86, < 90 points, and age < 62: therefore reduced ERF = 3% per year prior to age 65
ERF = 1-.03*(65-61) = 0.88
Annual Plan Benefit = 2% x $140,000 x 25 x 0.88 = $61,600

ITA Limit = DB Limit x Credited Service x ITA ERF
ITA ERF = 0.25% per month from the earlier of:

6. Continued

i. age 60 (Yes, met criteria)
ii. 30 years of service (No, does not meet criteria)
iii. 80 Points (Yes, meets criteria)

Unreduced ITA Limit

Annual DB Limit = \$2,914.44 x 25 x 100% = \$72,861

Benefit payable = min of (\$61,600, \$72,861) = \$61,600

(b) Calculate the monthly early retirement pension payable under each optional form of payment as at January 1, 2017.

Show all work.

(i) Joint and Survivor 66&2/3% pension:
Plan Reduced Pension x Life only at age 61 = X x Joint and survivor 66 2/3%
Joint and survivor 66 2/3% factor is not given so we must derive it = $\ddot{a}_{61}^{(12)}$ + 2/3 x ($\ddot{a}_{60}^{(12)} - \ddot{a}_{61:60}^{(12)}$)
= 17.7 + 2/3 x (18.1 – 15.3) = 19.5667
\$61,600 x 17.7 = X x 19.5667
X = \$55,723.24
Which is less than the ITA Limit of \$72,861, therefore the pension payable is \$55,723.24

(ii) Level income option, where CPP and OAS commence at age 65:
Offset benefit pays top up until 65 equal to the value of CPP/OAS at 65
CPP/OAS at 65 = \$1,114.17 + \$578.53 = \$1,692.70 per month (\$20,312.40 per annum)

PV of Normal Form Pension = X x $\ddot{a}_{61}^{(12)}$ + \$20,312.40 x $\ddot{a}_{61:\overline{4}|}^{(12)}$
\$61,600 x 17.7 = X x 17.7 + \$20,312.40 x 3.7
X = \$57,353.88
Therefore, lifetime pension is not capped at ITA Limit of \$72,861.

Bridge benefits are limited to 40% of the YMPE in the year of retirement where they are provided in lieu of lifetime pension benefits or 40% x 455,300 = \$22,120 per annum
Any bridge benefits provided in lieu of lifetime pension benefits are not counted for purposes of the combined lifetime and bridge benefits.

6. Continued

Therefore, a lifetime pension of $57,353.88 is payable plus a bridge pension of $20,312.40 until 65 or death (whichever is earlier).

Alternate solution:

PV of Normal Form Pension = X x $\ddot{a}^{(12)}_{61}$ *+ $20,312.40 x* $\ddot{a}^{(12)}_{61:\overline{4}|}$

PV of Normal Form Pension = X x $\ddot{a}^{(12)}_{61}$ *+ $20,312.40 x (* $\ddot{a}^{(12)}_{61}$ *-* $_4|\ddot{a}^{(12)}_{61}$ *)*

$61,600 x 17.7 = X x 17.7 + $20,312.40 x (17.7 – 14.3)
$61,600 x 17.7 = X x 17.7 + $20,312.40 x (3.4)
X = $57,698.18

Therefore, lifetime pension is not capped at ITA Limit of $72,861.

Bridge benefits are limited to 40% of the YMPE in the year of retirement where they are provided in lieu of lifetime pension benefits or 40% x $55,300 = $22,120 per annum. Any bridge benefits provided in lieu of lifetime pension benefits are not counted for purposes of the combined lifetime and bridge benefits.

Therefore, a lifetime pension of $57,698.18 is payable plus a bridge pension of $20,312.40 until 65 or death (whichever is earlier).

(c) Calculate the monthly early retirement pension payable under the normal form of payment as at January 1, 2017.

Show all work.

ERF = $_4|\ddot{a}^{(12)}_{61}$ / $\ddot{a}^{(12)}_{61}$ = 14.3 / 17.7 = 0.8079
Annual Plan Benefit = 2% x FAE x Credited Service x ERF
= 2% x $140,000 x 25 x 0.81 = $56,553
ITA maximum benefit payable = $72,861
Benefit payable = min of ($56,553, $72,861) = $56,553

(d) Explain, in words, how a 2% increase in the actuarial equivalence interest rate would affect the early retirement pension payable under the normal form.

The increase in the interest rate would not affect the Plan Benefit payable at normal retirement.

6. Continued

As interest rates increase, the actuarial equivalence early retirement reduction increases. Therefore, a 2% increase in the actuarial equivalence interest rate would result in a lower pension payable at early retirement under the normal form.

Given the early retirement pension is not capped by the ITA limit under either interest rate scenarios, the pension payable at early retirement would be reduced by an increase in the actuarial equivalence interest rate.

7. Learning Objectives:

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

Learning Outcomes:

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

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

Sources:

Reference - FR 127- 15 h New Brunswick, case for pension reform.

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe six of the principles that the Task Force on Protecting Pensions in New Brunswick established for the purposes of developing the Shared Risk Model.

Commentary on Question:

Candidates generally did well on this part

Six Principles established by the Task Force for developing the Shared Risk Model are:

1) Pension plans must be subject to robust risk management and be checked annually to ensure that the plan complies with that task.

2) A pension plan must provide Benefit Security. This means
(a) risk management targets are focused on delivering a high degree of pension security for members and retirees; and
(b) the plan must be governed by an independent trustee(s) who can force employers and employees to increase (or decrease) contributions when appropriate, subject to realistic and manageable limits.

3) A pension plan should be able to demonstrate that it will be sustainable over the long term.

4) A pension plan must be affordable, which means that contributions must be stable and affordable for both employer and employees.

5) The plan must be equitably designed - no single age cohort should unduly subsidize another, and no one should be able to 'game the system'. Also, by necessary implication, if pension plans amalgamate, no one plan may subsidize another.

7. Continued

6) The plan must be transparent. The pension goals and risks must be clearly stated up-front, who shares in the risks and rewards and by how much must be pre-established in the pension plan documents and everyone should know what the "pension deal" is or be able to find out what it is easily.

(b) Describe the features of New Brunswick's Shared Risk Model that help reduce the volatility of funding requirements while providing adequate protection of benefits.

Commentary on Question:
Candidates did poorly on this part. Most candidates did not describe all the key features, or their impacts on funding volatility and benefit protection. The question required more details in order to get full marks. Most candidates also did not mention the Funding policy features of the Shared Risk Model

Key features of the New Brunswick's Shared Risk Model are described below.

Benefit Structure:
Benefits are split into two parts:

- *Base benefits,* which is the amount of all benefits paid or payable based on vested ancillary benefits at the relevant date.
- *Ancillary benefits,* which are plan features such as cost-of-living increases, early retirement subsidies and improvements in the normal form of the pension.

Base benefits are very strongly funded, using a standard of success of at least 97.5% likelihood that base benefits need not be reduced. In some rare and unforeseen economic circumstances, the base benefits may be reduced. In these circumstance, the reduction is borne by all plan beneficiaries (actives, deferred, and retirees) in the same proportion. In the unlikely event that the benefit should decrease, the decrease will be temporary and restoration will have priority in any future year. The option to reduce pension benefits in times of financial stress, lowers the funding volatility as benefits can be reduced to keep the plan funded.

Up until the transition point, benefits are calculated as before. The new model establishes that amount as a base, and then increases it based on earnings and the performance of the plan moving forward. Benefits will be recalculated each year. Accrued final average benefits are frozen and converted to enhanced career average benefits prospectively. Automatic cost-of-living indexing is replaced by contingent indexing, reducing volatility in liabilities

The future benefit accruals are set at a level that can be supported by the agreed contributions. Tying future benefit accruals to an agreed contribution level reduces the risk of funding deficits and financial stress for the plan sponsor.

7. Continued

Contributions

Increased contributions are not an inherent part of the new model. However, there may be a need to increase contributions in the future to secure continued payment of base benefits. These automatic increases are capped at the greater of 2% of earnings or 25% of the initial contribution rate. Tying the contribution levels to the earnings and adding a cap helps the company fund the plan based on its ability at the time.

Contribution holidays are not permitted for employers and employees unless required under federal taxation rules. This ensures the plan is well funded in good times to provide benefit protection for future.

Funding Policy

Funding policy must be established to determine in normal times when the financial position of the pension fund is adequate to grant indexing and other additional ancillary benefits. The funding policy explains when contingent indexing starts or stops and at what levels contingent indexing payments are to be made. Contingent indexing allows benefits to be adjusted based on the plans performance, easing the burden of funding highly indexed benefits.

The plan is required to meet minimum standards to address underfunding situations. These standards allow the superintendent of pensions to issue guidance on what constitutes a minimum standard.

The plans funding policy must include an explicit deficit recovery plan and an explicit surplus utilization plan. Having an explicit deficit recovery plan helps reduce funding volatility and enhance benefit protection.

Administration and Risk Management

The Plan is operated at arm's length from the employer and is administered by a trustee
Each year, the trustee or trustees must:

- Ensure an actuary values the pension plan.
- Review the statement of investment policies and goals in view of the desired security levels.
- Ensure that the plan is exposed to risk-management procedures ("stress-testing").

Appropriate stress-testing is mandated as part of risk management to provide the flexibility and forewarning that enables plan administrators to take corrective measures so that target benefits are achieved with a high degree of confidence.

7. Continued

Stress testing on Shared Risk pension plans provides forewarning to the company which can then adjust the target benefits to avoid drastic volatility in the plan deficit and contribution requirements.

8. 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 and asset valuation methods.

Sources:

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

Commentary on Question:

Commentary is provided in each part.

Solution:

(a) Calculate the total accrued liability and total normal cost at December 31, 2017 under the following actuarial cost methods.

(i) Projected unit credit method, prorated on service.

(ii) Attained age normal method, as a level percentage of earnings

Show all work.

Commentary on Question:

Candidates generally performed well calculating the liability and normal cost using the PUC method. Some candidates had difficulty properly reflecting the multiple decrements. Candidates had more difficulty calculating results under the Attained Age Normal Method .

Projected Unit Credit Method

Member A

AL Dec. 31, 2017:A = 0.25 x 2% x \$80,000 x $(1.03)^{(63-62)}$ x 17 x 13.9 x $(1.05)^{-(63-62)}$ x [1 - 0.04 x (65 - 63)]+ 0.75 x 0.5 x 2% x \$80,000 x $(1.03)^{(64-62)}$ x 17 x 13.6 x $(1.05)^{-(64-62)}$ x [1 - 0.04 x (65 - 64)]+ 0.75 x 0.5 x 2% x \$80,000 x $(1.03)^{(65-62)}$ x 17 x 13.3 x $(1.05)^{-(65-62)}$ = \$341,503

NC 2018:A = \$341,503 / 17 = \$20,088

8. Continued

Member B
AL Dec. 31, 2017:B = 0.5 x 2% x $100,000 x 28 x 13.6 x [1 - 0.04 x (65 - 64)]+ 0.5 x 2% x $100,000 x $(1.03)^{(65-64)}$ x 28 x 13.3 x $(1.05)^{-(65-64)}$ = $730,875

NC 2018:B = 0.5 x 2% x $100,000 x $(1.03)^{(65-64)}$ x 13.3 x $(1.05)^{-(65-64)}$= $13,047

The total AL Dec. 31, 2017 = $341,503 + $730,875 = $1,072,378
The total NC 2018 = $20,088 + $13,047 = $33,135

Attained Age Normal Method
For each member, AL is determined using the unit credit cost method, as well as PVFB and PVFS. These results are then totaled. Note: The solution below uses the Traditional Unit Credit method to determine the AL. [*Alternatively; the Projected Unit Credit Method credit would also be acceptable, since this is a salary related plan]*.

Member A
ALDec. 31, 2017:A = 0.25 x 2% x $80,000 x 17 x 13.9 x $(1.05)^{-(63-62)}$ x [1 - 0.04 x (65 - 63)]+ 0.75 x 0.5 x 2% x $80,000 x 17 x 13.6 x $(1.05)^{-(64-62)}$ x [1 - 0.04 x (65 - 64)]+ 0.75 x 0.5 x 2% x $80,000 x 17 x 13.3 x $(1.05)^{-(65-62)}$ = $320,796 [*Or, $341,503 –PUC, see above*]

PVFBDec. 31, 2017:A = 0.25 x 2% x $80,000 x $(1.03)^{(63-62)}$ x 18 x 13.9 x $(1.05)^{-(63-62)}$ x [1 - 0.04 x (65 - 63)]+ 0.75 x 0.5 x 2% x $80,000 x $(1.03)^{(64-62)}$ x 19 x 13.6 x $(1.05)^{-(64-62)}$ x [1 - 0.04 x (65 - 64)]+ 0.75 x 0.5 x 2% x $80,000 x $(1.03)^{(65-62)}$ x 20 x 13.3 x $(1.05)^{-(65-62)}$ = $384,195

PVFSDec. 31, 2017:A= $80,000 x [$(1.03)^{(63-62)}$ + $(1.03)^{(64-62)}$ /1.05 x .75 + 0.75 x 0.5 x $(1.03)^{(65-62)}$ /1.052] = $172,757

Member B
ALDec. 31, 2017:B = 0.5 x 2% x $100,000 x 28 x 13.6 x [1 - 0.04 x (65 - 64)]+ 0.5 x 2% x $100,000 x 28 x 13.3 x $(1.05)^{-(65-64)}$ = $720,235 [*Or, $730,875]*

PVFBDec. 31, 2017:B = 0.5 x 2% x $100,000 x 28 x 13.6 x [1 - 0.04 x (65 - 64)]+ 0.5 x 2% x $100,000 x $(1.03)^{(65-64)}$ x 29 x 13.3 x $(1.05)^{-(65-64)}$ = $743,921

PVFSDec. 31, 2017:B = $100,000 x 1.03 x 0.5 = $51,500

8. Continued

Totals:
PVFBDec. 31, 2017 = $384,195 + $743,921 = $1,128,116
ALDec. 31, 2017 = $320,796+$720,235 = $1,041,031 [*Or, $1,072,378]*
UALDec. 31, 2017 = Greater of (ALDec. 31, 2017 - F; 0) = $1,041,031 - $950,000 = $91,031 [*Or, $122,378]*
PVFSDec. 31, 2017 = $172,757 + $51,500 = $224,257

NC%2018 = (PVFBDec. 31, 2017 - F - UALDec. 31, 2017)/(PVFSDec. 31, 2017) = ($1,128,116 - $950,000 - $91,031) / $224,257= 38.83% [*Or, 24.85%]*
NC2018 = NC%2018 x 2018 earnings = 38.83% x ($80,000x1.03 + $100,000x1.03x0.5) = $51,993 [*Or, $33,274]*

(b) Compare the pattern of cost recognition of the above two actuarial cost methods in (a). No calculations are required.

Commentary on Question:
Overall, candidates did not perform very well on this part of the question. Many candidates only mentioned one or two relevant points.

Similarities in cost recognition
- Both produce a stable normal cost if future members join with the same age distribution as the current ages of the present membership

Differences in cost recognition
- Under the PUC method,
  - NC is calculated separately for each member
  - If assumptions are as expected, as a member ages, the normal cost will increase as the member approaches retirement
  - Liability experience gains or losses are recognized immediately for each member
  - NC does not depend on investment gains or losses on the Fund
- Under the AAN method,
  - NC is calculated in aggregate and spread across all accruing members
  - If assumptions are as expected the normal cost will be a level % of pay for the period that the group of accruing members is the same
  - Liability experience gains or losses are spread across all accruing members, in aggregate, and over the period of expected future earnings
  - Investment gains or losses on the Fund are spread across all accruing members, in aggregate, and over the period of expected future earnings

9. Learning Objectives:

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

Learning Outcomes:

(3d) Perform valuations for special purposes, including:
- (i) Plan termination/wind-up/conversion valuations
- (ii) Hypothetical wind-up and solvency valuations
- (iii) Open group valuations
- (iv) Share risk pension plan valuations

Sources:

FR-104-13: Pension Projections

ASOP 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions

Commentary on Question:

Candidates were expected to compare how the assumptions differed between projections and valuations, as well as analyze the impact of different events on the assumptions. Many candidates did not note that events the plan sponsor expects or plans to happen are not reflected in the completed valuation's assumptions. Candidates also stated that 20-year projections were short-term and valuations were long-term (both are long-term), which led candidates to put incorrect conclusions about the projection assumptions.

Solution:

(a) Compare how the setting of the following assumptions varies for projection purposes versus going concern funding valuations:

(i) new entrants

(ii) retirement age

(iii) inflation

(iv) investment return

Commentary on Question:

Candidates in general answered (i) and (iii) correctly. Candidates generally stated that valuations used a single age while projections used a scale – while this can be true this isn't a generality. Also, many candidates did not note that the investment return for projections should take into account the year by year fluctuations of asset returns.

9. Continued

New entrants

- Allowance for new entrants very common in projections
  - Number of new entrants every year; profile of new entrants
- New entrants excluded from funding valuation results (balance sheet)

Retirement Age

- A more complex retirement assumption could be used for projection than valuation if justified by expectations
  - (can reflect change in retirement age in projection period due to plan provision change, company strategy, economic conditions, etc.)
- However, the same assumption for valuation and projection could be used.

Inflation

- A more complex retirement assumption could be used for projection than valuation if justified by expectations
  - (can reflect change in inflation in projection period due to economic conditions, etc.)
- However, the same assumption for valuation and projection could be used.

Investment Return

- Generally held constant for valuation purposes
- For projections, it needs to be realistic on an annual basis. Therefore, it will typically vary year to year to reflect the expected economic conditions and investment policies in the future.
- For projections, if the asset mix is expected to be adjusted as the funded position of the plan changes, the impact of new asset mixes on the assumption should be reflected in the projection period.

(b) Explain how your answer in (a) would change in the event that ABC Company is planning an early retirement window in 2 years.

Commentary on Question:
Many candidates did not comment on assumptions other than the retirement age assumption.

9. Continued

- Retirement age assumption would be revised for the projections only.

- Retirement age assumption in the projection period to reflect change in retirement behavior related to the early retirement window. It would be assumed that members would retire at higher pace during that time and slower afterwards (because more people will have retired).

- The early retirement window would not be reflected in the filed valuation as it was not a known subsequent event.

- Other assumptions would not be impacted by the early retirement window.

(c) Explain how your answer in (a) would change in the event that a recession is expected to occur in 5 years.

Commentary on Question:
While this part was answered well, many candidates did not comment on all assumptions or did not differentiate valuation and projection assumptions.

- No impact for funding valuation purposes

- Less new entrants starting in the 5^{th} year could be reflected for projection purposes

- Impact of recession could be reflected in the retirement assumption for projection purposes. For example, people might decide not to retire during the recession

- Lower inflation should be reflected resulting in the decrease of other inflation-related assumptions (such as salary scale) in the years of recession for projection purposes

- Lower future expected investment returns should be reflected resulting in a lower discount rate in the years of recession for projection purpose

10. 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 and asset valuation methods.

Sources:

Calculation of Incremental Cost on a Hypothetical Wind-Up or Solvency basis, CIA Educational Note

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the 2018 Solvency Incremental Cost (SIC) for each member.

Show all work.

Commentary on Question:

Most Candidates were able to calculate the Solvency Incremental Cost for at least one member properly. However many of the key differences between the members were missed by most candidates.

Member A (Age 45, Service 9)

Time 0 (January 1, 2018) Calculations

Points = Age + Service = 45 + 9 = 54

No grown-in as less than 55 points - Actuarially reduced from age 65

Assume Member A retires at age 65

No reduction applied at age 65

FAE3 (2014 - 2016) = ($50,000 + $52,000 + $53,000) / 3 = $51,667.67

Accrued Pension = 2% x $51,667.67 x 9 = 9,300

Annuity Factor (age 45 deferred for 20 years) = 9.06

Solvency Liability at time 0 (January 1, 2018) = $9,300 x 9.06 = $84,258

10. Continued

Time 1 (January 1, 2019) Calculations

Age = 46

Service = 10

Points = 46 + 10 = 56
Grow-in to Early Retirement Subsidies - more than 55 points

Project FAE (2015 - 2017) = ($52,000 + $53,000 + $54,590) / 3 = $53,196.67

Accrued Pension = 2% x$ 53,196.67 x 10 = $10,639

Test retirement at age 62 (unreduced) and age 55 (21% reduction)

Age 62 Unreduced

Annuity Factor (age 46 deferred for 16 years to age 62) = 10.96

Solvency Liability at time 1 = $10,639 x 10.96 = $116,603

Age 55 Reduced by 21%

Annuity Factor (age 46 deferred for 9 years to age 55) = 15.43
Solvency Liability at time 1(January 1, 2019) = $10,639 x (1-21%) x 15.43 = $129,686

Maximum Value = Age 55
Discount Liability at Time 1 (January 1, 2019) back by 3% = 129,690 / 1.03 = $125,909
Solvency Incremental Cost at time 0 (January 1, 2018) = $125,909 - $84,258 = $41,651

Member B (Age 54, Service 20)

Time 0 (January 1, 2018) Calculations
Points = Age + Service = 54 + 20 = 74
Grow-in to Early Retirement Subsidies - more than 55 points

Accrued Pension = 2% x $87,333.34 x 20 = $34,933

Test retirement at age 62 (unreduced) and age 55 (21% reduction)

10. Continued

Age 62 Unreduced

Annuity Factor (age 54 deferred for 8 years to age 62) = 13.71

Solvency Liability at time 0 (January 1, 2018) = $34,933 x 13.71 = $478,936

Age 55 Reduced by 21%

Annuity Factor (age 54 deferred for 1 years to age 55) = 19.32

Solvency Liability at time 0 (January 1, 2018) = $34,933 x (1-21%) x 19.32 = $533,180

Maximum Value = Age 55

Solvency Liability at time 0 (January 1, 2018) = $533,180

Time 1 Calculations

Age = 55

Service = 21

Points = 55 + 21 = 76

Grow-in to Early Retirement Subsidies - more than 55 points

Project FAE (2015 - 2017) = ($88,000 + $89,000 + $91,670) / 3 = $89,556.67

Accrued Pension = 2% x $89,556.67 x 21 = $37,614

Use Age 55 with 21% reduction

Annuity Factor (age 55 deferred for 0 years) = 19.90

Solvency Liability at time 1 (January 1, 2019) = $37,614 x (1-21%) x 19.90 = $591,330

Discount Liability at Time 1 (January 1, 2019) back by 3% to January 1, 2018 = $591,330 / 1.03 = $574,107

Solvency Incremental Cost at time 0 (January 1, 2018) = $574,107 - $533,180 = $40,927

10. Continued

Member C (Age 62, Service 35)

Time 0 (January 1, 2018) Calculations
Points = Age + Service =62 + 35 = 97
Grow-in to Early Retirement Subsidies - more than 55 points

Accrued Pension = 2% x $91,666.67 x 35 = $64,166.67

Assume Immediate Retirement - age 62

Annuity Factor (age 62 deferred for 0 years) = 17.12
Solvency Liability at time 0 (January 1, 2018) = $64,166.67 x 17.12 = $1,098,533

Time 1 (January 1, 2019) Calculations

Age = 63

Service = 36

Project 2017 salary at 3% = $93,000 x 1.03 = $95,790

Project FAE (2015 - 2017) = ($92,000 + $93,000 + $95,790) / 3 = $93,596.67

Accrued Pension = 2% x $93,596.67 x 36 = $67,390

Assume Immediate Retirement - Age 63

Annuity Factor (age 63 deferred for 0 years) = 16.73

Solvency Liability at time 1 (January 1, 2019) = $67,390 x 16.73 = $1,127,435
Discount Liability at Time 1 (January 1, 2019) back by 3% to January 1, 2018= $1,127,435 / 1.03 = $1,094,597
Solvency Incremental Cost at time 0 (January 1, 2018) = $1,098,533 - $1,094,597 = ($3,936)

(b) Discuss the differences between the Solvency Incremental Cost and the going concern normal cost by member.

Commentary on Question:
Most candidates did poorly on part b and did not provide enough differences for each member to receive full mark.

10. Continued

For all members

- Going concern (GC) liabilities are accrued over the working lifetime of the member based on assumed projected salary growth and retirement age.
- GC normal cost (NC) represents the change in expected GC liabilities during the year and under the projected unit credit method, increases as a member ages.

- Solvency incremental cost (SIC) is the difference in:
    - solvency liabilities at the end of the year, discounted with interest to the beginning of the year; and
    - solvency liabilities at the beginning of the year,

  where the solvency liabilities on a valuation date assume a member's accrued entitlements are settled on the valuation date (i.e., 100% decrement). For example, the solvency liabilities at the valuation date are based on: accrued service to the valuation date, final average earnings at the valuation date; whether eligibility for grow-in was satisfied at the valuation date.

Member A

SIC is higher than NC because

- Solvency liabilities at 1/1/2019 are based on an optimal retirement age of 55 and the early retirement subsidies are included in the solvency liabilities and expected final average earnings to January 1, 2019..
- The solvency liabilities at 1/1/2018 are much lower because it is based on a retirement age of 65 and final average earnings to January 1, 2018, therefore resulting in high SIC.
- Whereas, the GC NC is based on the same projected final average earnings and early retirement subsidies (i.e., pension) to age 62.

Member B

SIC higher than NC due to

- Accrued pension is higher at 1/1/2019 than at 1/1/2018 for SIC which reflects growth in the accrued final average earnings
- Whereas NC is based on the same projected final average earnings and early retirement subsidies (i.e., pension) to age 62.

10. Continued

Member C

SIC lower than NC because

- the present value of the benefit pay-out in 2018 is higher than the present value of the increase in pension from 1/1/2018 to 1/1/2019 for SIC.
- Whereas NC is based on the same pension projected to age 63.

11. Learning Objectives:

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

Learning Outcomes:

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

Sources:

PSPA guide

PAR guide

Canadian Pensions and Retirement Income Planning, Willis Towers Watson, Chapters 10 and 11

Handbook of Canadian Pension and Benefits Plan, Morneau Shepell, Chapter 8

Commentary on Question:

Question was testing candidates understanding of pension legislation as it pertains to PSPAs PAs and PARs. Additional Commentary provided below.

Solution:

(a) Calculate the maximum increase to the benefit rate that may be granted on December 1, 2018 for all past years of service such that no Past Service Pension Adjustment (PSPA) is required to be reported.

Show all work.

Commentary on Question:

Award full points if answer is correct and the process is reasonably clear. If candidate did not show calculation for A), or B), deduct 2 marking points for each step.

Candidates did well on part A for the most part. Many lost part marks for not correctly calculating the service period correctly or failing to apply all years of AIW

- Total AWI increase for period between amendments 1.021*1.024*1.007 – 1 = 5.28%

A) 5.28% * 50 * 12 = 31.68 per year

B) 1.50 per month * 12 * 3.9167 years = 70.50 per year

- Maximum benefit rate increase before trigger PSPA is maximum of A or B which is $70.50 per year or $5.88 per month

Maximum increase is $5.88 to a benefit rate of $55.88 per month.

11. Continued

(b) List the requirements for a PSPA to be exempt from certification.

Commentary on Question:
Candidates seemed to do very well or very poorly on this part of the question. 10 total points below, candidate that lists any 4 of the 5 criteria will get full credit for part B

The past service improvement meets following criteria:

1. Plan must have at least 10 active members who are earning benefits under the Plan [2 points]
2. Substantially all of the active members who are earning benefits under the plan's defined benefit provision are receiving the improvement [2 points]
3. Improvements in benefits are not more advantageous for inactive members than for active members [2 points]
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 [2 points]
5. Improvements not provided disproportionately to "specified active members"

(c) Calculate the PSPA for the member.

Show all work.

Commentary on Question:
Full points awarded if answer is correct and the process is reasonably clear. Deduct 3 marking points for each incorrect answer in the bullets below.

This part of the question was generally done well.

- $10 – $5.88 = $4.12 increase per month is subject to PSPA
- PSPA per year of service from 2016 and 2017 is 9*(4.12)*12 = $444.96 per year of service
- Total PSPA = 2*$444.96 = $890

(d) The member terminated on February 1, 2019 and received a lump sum transfer of $14,000.

Calculate the Pension Adjustment Reversal.

Show all work.

11. Continued

Commentary on Question:
Deduct 2 marking points for each of the first three bullets that is incorrect. Candidates under sttod the concept of the PAR well. If marks were lost it was a result of not correctly calculating the PAs (especially for 2019).

- PA = 9 * (50 *12) * 1 - 600 = 4,800 per year for 2016 & 2017
- 2018 PA = 9 * 60 * 12 * 1 – 600 = 5,880
- 2019 PA = 9 * 60 * 12 * (.0833) – 600 = 0
- Total PA reported = 2*4,800 + 5,880 + 0 = $15,480
- PAR = Total PA + Total PSPA – Lump sum paid = 15,480 + 890 – 14,000 = $2,370

12. Learning Objectives:

1. The candidate will understand how to analyze data for quality and appropriateness.

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

Learning Outcomes:

(7b) Explain and apply the Professional Conduct Guidelines.

(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 Data Quality

CIA Consolidated Standards of Practice, Sections 1530, 1600, 3100 – 3500

Commentary on Question:

Candidates were expected to know the minimum required data to perform a valuation, identify and explain different approaches for missing members, and to apply the standards of practice for reporting on valuation results where data is insufficient and/or defective.

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

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

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

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

Solution:

(a) List the minimum data required to complete the valuation for the 8,000 members that you received data for.

12. Continued

Commentary on Question:
The three key data fields are Date of Birth, Year of Credited Service, and Pay Grade. Additional credit was awarded to candidates who listed other relevant data fields. Candidates generally performed well on part (a).

- Date of Birth
- Years of Credited Service
- Pay Grade
- Gender
- Salary
- Status (i.e. active, suspended, or deferred vested)
- Date of Hire

(b) Describe how you would address the missing data for the other 2,000 members in order to complete the valuation.

Commentary on Question:
Credit was awarded to candidates who provided a valid description and explanation of different ways to address missing data. While most candidates were able to state that the data of the 8,000 known members could be used as a proxy for the missing members, few took the extra step to explain how that data would be used. Also, few candidates discussed other possible approaches (such as using industry averages).

- Confirm if the population for the active members is homogenous
  - i.e. are the 8,000 members where information was provided a fair representation of the entire population.
  - If so, can use information for the 8,000 members as estimates for the 2,000 members
  - If these 2,000 members are different, how are they different with respect to the important data fields
    - e.g. age, gender, credited service, pay grade, salary
- Understand the reason for the missing data for these members
  - May provide insight to the characteristics of these members
  - Confirm the status of these 2,000 members
    - Are they still actively employed?
    - If not, should they be treated as suspended or deferred vested members who are no longer accruing service.
- Confirm if there are industry averages that can be used to represent these 2,000 members
  - e.g. average salary, gender, age

12. Continued

(c) Describe how you would disclose the assumptions made for missing data in the actuarial valuation report, taking into consideration professional standards.

Commentary on Question:
A successful candidate recognized that the data provided, while insufficient and defective, is still useable and therefore the disclosure should reflect as such.

- As required by the professional standards, any assumptions and methods used in respect of insufficient or unreliable membership data must be described in the actuarial valuation report
- The missing data in this case should be classified as defective, but not so as to negate the usefulness of the result
- The actuary in this case would report a usual opinion with reservation which describes the defect, describes the work done and assumptions (such as using industry average for salary) made to cope with the defect
- In addition, if practical, the actuary should also quantify the effect of the defect on the result (i.e., present sensitive results of using more conservation assumptions for missing data)