RET FRC Model Solutions
Fall 2022

1. **Learning Objectives:**
1.   The candidate will understand how to analyze data for quality and appropriateness.

Learning Outcomes:
(1a)   Identify data needed.

(1b)   Assess data quality.

Sources:
ASOP 23, FR-149-21:Does Your Pension Data Need a Refresh, CSOP 1440, 1510, 1530

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Identify the data quality issues.

Commentary on Question:
Successful candidates were able to correctly identify the specific data issues mentioned below. Points were not awarded without specifically identifying the member IDs, nor providing an appropriate explanation of the data issue.

Schedule A:
- -- ID 5: Status Survivor/Form of Pension is Joint & Survivor 75%, but no Spouse DOB is listed, either the form of pension is incorrect, or the status is incorrect, in which case the spouse date of birth is missing

- -- ID 7: Spouse Sex: N/A with a J&S100% pension form

- -- ID 9: Date of Retirement is listed as a date in the future: 12/1/2027

- -- ID 15: Date of Retirement: 5/1/2013, but Form of Payment is listed as G5

- -- ID 25: Spouse Date of Birth listed as 1/2/1930; a 22-year age difference with member is very high.

1. Continued

- -- ID 27: Monthly Pension: $18,000, which is much higher than every other pension.

Schedule B:
- -- ID 32: Monthly Pension: $80 seems low compared to other members

- -- ID 34: Normal Retirement Date: 5/1/2025 which is the 55th birthday of the member, while all other members have a NRD at age 65.

- -- ID 38: Earliest Unreduced Retirement Date listed as 11/1/2023, which is the 45th birthday of the member, but the plan doesn't allow early retirement before age 55.

- -- ID 39: Date of Birth: 11/29/1949 (age 71) but listed in Deferred Vested status. Member would have been expected to start deferred pension no later than age 65.

(b)   Recommend a course of action to address the data quality issues identified in (a).

Commentary on Question:
Successful candidates were able to articulate specific steps to rectify the data issues described above. No points were awarded for references to the CIA Standards of Practice or Rules of Professional Conduct.

- Confirm with client if he can help respond to the data issues using the information he has on file.
- Confirm with client if he can provide valuation data files from the plan administrator to compare and correct data.
- For immediate annuitants, request client to provide financial statements to reconcile pension payments (would help to confirm monthly pension amount for member ID 27 and total pension payments).
- For immediate annuitants, request client or plan administrator to provide retirement option forms to confirm monthly pension amounts and forms of pension.
- For deferred annuitants, request client or plan administrator to provide termination statements to confirm monthly pension amount at NRD, NRD and EURD.
- If some data issues cannot be resolved, consider making assumptions but disclose these assumptions to the insurers.
- Consider contacting the members to confirm their personal information (only applicable for dates of birth, e.g. for member ID 25).

1. **Continued**

(c) Recommend a course of action to potentially reduce the annuity purchase premium.

Commentary on Question:
Successful candidates were able to describe specific actions to reduce annuity purchase premiums in the context of the data issues presented earlier in the question.

a. Make a survival audit
  - Helps reinforce the integrity and accuracy of the data
  - Helps confirm if spouses are still alive to avoid paying a premium for survivor pensions
  - Helps avoid potential disputes or payment delays following the death or retirement of a former plan member
  - Helps ensure addresses on file are up to date for pensioners and deferred members

b. Offer a one-time lump sum transfer option to deferred annuitants
  - Reduces the investment risk, interest rate risk and longevity risk
  - Helps locate any missing members
  - Helps improve data accuracy, which will be needed to re-calculate the deferred member's commuted value
  - As it reduces future administrative costs, it will reduce the annuity premium since insurers don't have to consider additional margins for deferred members
  - It will increase insurer attraction as the number of deferred members will have decreased

2. **Learning Objectives:**

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

Learning Outcomes:

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

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

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

Sources:

Selection of Mortality Assumptions for Pension Plan Actuarial Valuations, CIA Educational Note, Dec 2017

Guidance on Selection and Disclosure of Plausible Adverse Scenarios, CIA Educational Note, Feb 2019

Commentary on Question:

The question was to test candidates' understanding when a plan may require adjustment to the mortality assumption for a going concern valuation to reflect pension plan membership characteristics.

Solution:

(a) Describe the considerations for adjusting the mortality assumption for a going concern valuation to reflect pension plan membership characteristics.

Commentary on Question:

Many candidates discussed the credibility of data without mentioning the specific adjustments listed. Further, candidates were expected to provide brief commentary on each adjustment factor listed to get full marks. The illustrative solutions list key factors and adjustments identified from the source materials but other appropriate considerations for adjusting the mortality assumption will also receive points.

Important factors to consider in establishing a mortality assumption include:

1. Nature of Employment

- Private/Public Sector Workers

  Relying solely on public or private sector employment as a determinant for mortality table selection without considering the underlying industry has practical limitations. Judgment would be applied in selecting among tables based on sector.

2. **Continued**

- Collar Type (blue collar vs. white collar workers)

  Mortality experience analysis by collar type in broad-based experience studies may be restricted by the quality of the data available and the ability to classify it into collar types.

  The actuary would exercise care in combining collar experience in one study with overall experience in another as combining such experience may not yield satisfactory results due to underlying differences in the demographic profiles studied.

- Industry - demographic and occupational factors

  Mortality experience by industry may also be analyzed in conjunction with the preparation of broad-based experience studies. However, to date, industry analysis has not proven to be conclusive.

  Industry information would be used with caution.

    o An adjustment may be considered for a plan covering members in an industry which exhibits credible mortality experience that is significantly higher or lower than average.

    o Larger, more homogeneous groups, such as university professors or teachers, will likely have more credible results in an industry experience study than smaller, diverse industries

2. **Relative amount of pension payments**

- Pension Size

  The use of size adjustments is a practice which may be considered where actual plan experience is not fully credible and industry adjustments are not available or are otherwise deemed inappropriate.

    o An adjustment would typically be considered when a plan has pension amounts or active members' earnings levels which are significantly higher or lower than the corresponding amounts underlying the base table for a selected published mortality study.

    o Use of pension size is a proxy for socio-economic status. The relationship between pension size and life expectancy is likely one of correlation rather than cause.

    o Examples of other factors which may correlate with socio-economic status include, but are not limited to, place of residence (i.e., postal code) and level of education

2. Continued

- o If size adjustments are used, a satisfactory approach may be to determine a single weighted size adjustment factor for each gender using the average size adjustment factor weighted by pension amount. The actuary would then select the associated published mortality table, differing by age and gender, with a percentage adjustment to mortality rates to approximate the effect of applying size adjustments

- o Size adjustments would typically not be revised annually. Typically, the same adjustments for pension size used for retirees would be applied to survivors. If no major shift in demographics has occurred or is anticipated, it is generally reasonable to also apply the same adjustments to active and deferred members as for retirees

- Pension amount indexed or not

  If and when pension size bands are adjusted for increases in wages, a fully indexed plan would have to adjust only for changes in the spread between the increase in average industrial wages and the level of indexation provided by the plan. For a non-indexed plan, it would often be appropriate to compare the pension payable to the pension size bands at time of retirement.

3. Other

- Combinations of Adjustments for Plan Membership Characteristics

  Caution would be used in deriving adjustments for variations in more than one plan characteristic (collar, industry, sector type, pension amount, and/or other socioeconomic indicators) at the same time, as the combined effect may overstate or understate the actual relationship.

  A reasonable approach would be to consider adjustments to the published mortality table based on each characteristic separately. The alternative adjustments derived by considering each characteristic separately may be helpful in narrowing down a reasonable range and selecting a final assumption.

(b) Describe possible approaches for reflecting a plausible adverse scenario for the longevity risk of a pension plan.

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

Longevity riskis the risk that pension plan members will live longer than expected. In selecting the plausible adverse scenario, the actuary would consider plan-specific factors affecting potential longevity experience.

2. **Continued**

Two possible approaches to measuring the sensitivity of the disclosure item to changes to the mortality assumption are:

- The impact of the life expectancy of members being one year higher than assumed. An age setback could be used to estimate the effect of increased life expectancy.
- The impact of a percentage adjustment to mortality rates. For example, the effect of decreasing mortality rates at all ages by 10 percent may be disclosed.

3. **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.

(3e) 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

(3f) Calculate actuarially equivalent benefits.

(5g) The candidate will be able to describe and apply regulation pertaining to reporting requirements.

Sources:

Canadian Pensions and Retirement Income Planning, Willis Towers Watson, 6th Edition, 2017 Ch. 15 (excluding Section 1525)

Morneau Shepell Handbook of Canadian Pension and Benefit Plans, 17th Edition, 2020 Ch. 3 and 6 (excluding pp. 176-183)

Pension Mathematics for Actuaries, Anderson, Arthur W., 3rd Edition, 2006 Ch. 1-4 and 7

Commentary on Question:

Candidates were asked to calculate the funded status of the plan on a going concern, solvency, and hypothetical wind-up basis, and calculate contributions and perform a gain and loss analysis. While candidates were able to successfully complete some portions of the question, candidates struggled with other portions. Minor calculation errors were tracked through and resulted in minimal deductions if the rest of the calculations were done correctly.

Solution:

(a) Calculate the funded status of the plan on a going concern basis.

Commentary on Question:
Most candidates were able to calculate the liabilities for the deferred pensioners and pensioners correctly, with candidates struggling with calculating the liability for the active members correctly. Some candidates did not calculate the PfAD with non-indexed liabilities.

Asset Value	1,287,780
Going concern funding target	
Going concern liabilities:	
Active members	293,593
Deferred pensioners	313,261
Pensioners	1,241,200
Subtotal	
PfAD	184,479
Total	**2,032,533**
Funding excess (shortfall)	**(744,753)**

Member ID	ID1		2019	49,000								
Current age	43		2020	50,000								
Service	12.00		2021	65,000								
	Age	Years to Decrement	Projected earnings	Projected pension	ERF	QxT	QxR	tPxV	Factor (indexed)	Factor (non-indexed)	AL (indexed)	AL (non-indexed)
Termination	43	0	54,667	13,120	100%	5%	0%	1.0000	5.3	4.4	3,498	2,893
Termination	44	1	60,758	14,582	100%	5%	0%	0.9048	5.6	4.6	3,694	3,054
EURA	62	19	120,784	28,988	100%	0%	60%	0.3571	16.9	13.7	104,981	85,103
NRD	65	22	133,916	32,140	100%	0%	100%	0.1234	15.6	12.9	61,874	51,165
											174,047	**142,216**

Projected earnings calculation:
- $54{,}667 = \text{AVERAGE}(49000, 50000, 65000)$
- $60{,}758 = \text{AVERAGE}(65000 \times 1.035^1, 65000 \times 1.035^0, 50000)$
- $120{,}784 = \text{AVERAGE}(65000 \times 1.035^{19}, 65000 \times 1.035^{(19-1)}, 65000 \times 1.035^{(19-2)})$
- $133{,}916 = \text{AVERAGE}(65000 \times (1+0.035)^{22}, 65000 \times (1+0.035)^{(22-1)}, 65000 \times (1+0.035)^{(22-2)})$

tPxV calculation:
- $0.9048 = ((1-0.05) \times (1-0))/(1+0.05)^1$
- $0.3571 = ((1-0.05) \times (1-0) \times (1-0.05) \times (1-0))/(1+0.05)^{19}$
- $0.1234 = ((1-0.05) \times (1-0) \times (1-0.05) \times (1-0) \times (1-0) \times (1-0.6))/(1+0.05)^{22}$

3. Continued

Member ID	ID2		2019	78,000								
Current age	60		2020	78,000								
Service	5.00		2021	83,000								
	Age	Years to retirement	Projected earnings	Projected pension	ERF	QxT	QxR	tPxV	Factor (indexed)	Factor (non-indexed)	AL (indexed)	AL (non-indexed)
Age 62	62	2	85,939	8,594	92%	0%	60%	0.9070	16.9	13.7	72,960	59,145
NRD	65	5	95,282	9,528	100%	0%	100%	0.3134	15.6	12.9	46,585	38,522
											119,546	**97,668**

Projected earnings calculation:
- 85,939=AVERAGE(83000*1.035^2,83000*1.035^(2-1),83000*1.035^(2-2))
- 95,282=AVERAGE(83000*1.035^5,83000*1.035^(5-1),83000*1.035^(5-2))

tPxV calculation:
- 0.9070=1/(1+0.05)^2
- 0.3134= (1-0-0.6)/(1+0.05)^5

Deferred:	Indexed AL		Non-indexed AL	
	ID3	ID4	ID3	ID4
Age	58	35	58	35
Lifetime pension	25,000	10,000	25,000	10,000
EURA	65	65	65	65
Lifetime factor	15.60	15.60	12.90	12.90
AL	277,166	36,095	229,195	29,848

Pensioner:	Indexed AL		Non-indexed AL	
	ID5	ID6	ID5	ID6
Age	72	68	72	68
Spouse Age	70	n/a	70.00	n/a
Lifetime pension	50,000	36,000	50,000	36,000
Lifetime factor	14.60	14.20	12.20	11.90
AL	730,000	511,200	610,000	428,400

Determine PfAD			
1) 5.0% for a closed plan			5.00%
2) Provision based on Combined Target Asset Allocation for Non-Fixed Income Assets			7.00%
3) BDR > GC DR			0.00%
PfAD			**12.00%**

(b) Calculate the funded status of the plan on a solvency basis and on a hypothetical wind-up basis.

3. Continued

Commentary on Question:
Candidates generally performed well in this question and were able to calculate the liabilities correctly for the inactive members. Some candidates did not calculate the active liabilities correctly for Member ID1, some common mistakes were using the wrong early retirement factor, using the wrong annuity factors, and not taking the average of their optimal value and earliest unreduced commuted value.

Solvency assets	1,187,780
Present value of accrued benefits for:	
Active members	256,163
Deferred pensioners	408,500
Pensioners	1,310,000
Total solvency liability	1,974,663
Solvency excess (shortfall)	(786,883)
Hypothetical wind-up assets	1,187,780
Present value of accrued benefits for:	
Active members	334,699
Deferred pensioners	515,000
Pensioners	1,628,200
Total hypothetical wind-up liability	2,477,899
Hypothetical wind-up excess (shortfall)	(1,290,119)

Member ID		ID1	2019	49,000	Optimal Value		207,821	150,093
Current age		43	2020	50,000	Earliest Unreduced		173,184	131,200
Service		12.00	2021	65,000		**Liability**	**190,502**	**140,646**
	55 points at Valuation Date - Grow In							
20 years of service at		51						
				Reduced	Indexed LS	Non-Indexed LS		
Member ID		FAE3	Reduction	Accrued pension	Factor	Factor	AL Indexed	AL Non-Indexed
55		54,667	20%	10,496	19.80	14.30	207,821	150,093
56		54,667	18%	10,758	18.70	13.70	201,182	147,390
57		54,667	16%	11,021	17.70	13.00	195,068	143,270
58		54,667	14%	11,283	16.70	12.40	188,429	139,912
59		54,667	12%	11,546	15.80	11.70	182,420	135,084
60		54,667	10%	11,808	14.90	11.10	175,939	131,069
61		54,667	8%	12,070	14.00	10.60	168,986	127,946
62		54,667	0%	13,120	13.20	10.00	173,184	131,200
63		54,667	0%	13,120	12.40	9.50	162,688	124,640
64		54,667	0%	13,120	11.60	9.00	152,192	118,080
65		54,667	0%	13,120	10.90	8.50	143,008	111,520

3. Continued

Member ID		ID2	2019	78,000	Optimal Value		144,197	115,517
Current age		60	2020	78,000	Earliest Unreduced		144,197	115,517
Service		5	2021	83,000	**Liability**		**144,197**	**115,517**
	55 points at Valuation Date - Grow In							
20 years of service at		75						
				Reduced	Indexed LS	Non-Indexed LS		
Member ID		FAE3	Reduction	Accrued pension	Factor	Factor	AL Indexed	AL Non-Indexed
60		79,667	24%	6,059	23.80	18.80	144,197	115,517
61		79,667	20%	6,380	22.60	17.90	144,197	115,517
62		79,667	15%	6,738	21.40	17.00	144,197	115,517
63		79,667	11%	7,103	20.30	16.10	144,197	115,517
64		79,667	6%	7,510	19.20	15.30	144,197	115,517
65		79,667	0%	7,967	18.10	14.50	144,197	115,517

Deferred:	Wind-up AL		Solvency AL	
	ID3	ID4	ID3	ID4
Age	58	35	58	35
Lifetime pension	25,000	10,000	25,000	10,000
Optimal Age = NRD = EURA	65	65	65	65
Reduction	0%	0%	0%	0%
Lifetime factor LS	17.2	8.5	13.7	6.6
AL	430,000	85,000	342,500	66,000

Pensioner:	Wind-up AL		Solvency AL	
	ID5	ID6	ID5	ID6
Age	72	68	72	68
Spouse Age	70.00	n/a	70.00	n/a
Lifetime pension	50,000	36,000	50,000	36,000
Lifetime factor AP	19.1	18.70	15.4	15.00
AL	955,000	673,200	770,000	540,000

(c) Calculate the minimum required and maximum permissible employer contributions for 2022 and the estimated minimum required employer contributions for 2023.

Commentary on Question:
Many candidates did not net the employee contributions from the employer current service cost contributions or failed to include the expense allowance with PfAD. Some candidates did not calculate the normal cost correctly or did not apply the PfAD calculation to their non-indexed normal cost calculation.

2022 Employer Minimum Contribution Requirements	Alternative Solution	
	Option 1	Option 2
Employer current service cost contributions	90,779	90,779
Special payments	33,000	40,000
Minimum required employer contributions for 2022	**123,779**	**130,779**
Maximum permissible employer contributions for 2022	1,380,898	1,380,898
2023 Estimated minimum required employer contributions		
Employer current service cost contributions	92,629	92,629
Special payments	109,860	121,860
Minimum required contributions for 2023	**202,489**	**214,489**

Member ID	ID1			
Current age	43			
Service	12.00			
	Age	Projected pension (NC)	NC (indexed)	NC (non-indexed)
Termination	43	14,213	292	241
Termination	44	15,797	308	255
EURA	62	31,404	8,748	7,092
NRD	65	34,818	5,156	4,264
			14,504	**11,851**

Member ID	ID2			
Current age	60			
Service	5.00			
	Age	Projected pension (NC)	NC (indexed)	NC (non-indexed)
Age 62	62	10,313	14,592	11,829
NRD	65	11,434	9,317	7,704
			23,909	**19,534**

Part (c) - Minimum Required Contributions	2022	2023
Total Normal Cost	38,413	40,334
PfAD on Non-Indexed CSC	3,766	3,954
Total Current Service Cost	**42,179**	**44,288**
Employee Contributions	**7,400**	**7,659**
Employer Portion of Normal Cost	**34,779**	**36,629**
Explicit Expense Allowance	50,000	50,000
PfAD on explicit expense allowance	6,000	6,000
Total Expense Allowance	56,000	56,000
Total Employer Current Service Cost Contributions	**90,779**	**92,629**

3. **Continued**

Maximum Contribution Calculations		
Normal Cost (ER Portion)		90,779
Wind-up Deficit		1,290,119
Total		**1,380,898**

Discount rates	going concern			5.00%			
	solvency			2.57%			
Going Concern excess/(shortfall)	(744,753)						
Solvency excess/(shortfall)	(786,883)						
Reduced Solvency excess/(shortfall)	(490,684)						
Existing Special Payments Schedule (from previous valuation schedule)							
					Remaining		
Type	**Start**		**End**	**Monthly Amount**	**Months**	**GC PV**	**Solvency PV (5 years)**
GC One		1/1/2021	12/31/2021	5,500	-		
GC Two		1/1/2022	1/1/2032	750	120	$71,074	$42,222
Solvency One		1/1/2018	12/31/2022	1,000	12		$11,837
Solvency Two		1/1/2022	12/31/2026	2,000	60		$112,593
						$71,074	$166,652
New Special Payment Schedule - Option 1							
					Remaining		
Type	**Start**		**End**	**Monthly Amount**	**Months**	**GC PV**	**Solvency PV (6 years)**
GC exisiting		1/1/2022	12/31/2022	750	12	$8,766	$8,878
GC (new)		1/1/2023	12/31/2032	8,155	120	$736,013	$447,615
						$744,779	$456,492
Solvency One		1/1/2018	12/31/2022	-	12		$0
Solvency Two		1/1/2022	6/30/2023	2,000	18		$35,287
							$491,780
Special payment Requirement - Option 1	**2022**		**2023**				
Going Concern	9,000		97,860				
Solvency	24,000		12,000				
Total	**33,000**		**109,860**				
New Special Payment Schedule - Option 2							
					Remaining		
Type	**Start**		**End**	**Monthly Amount**	**Months**	**GC PV**	**Solvency PV (5 years)**
GC exisiting		1/1/2022	12/31/2022	750	12	$8,766	$8,878
GC (new)		1/1/2023	12/31/2032	8,155	120	$736,013	$362,569
						$744,779	$371,446
Solvency One		1/1/2018	7/31/2022	1,000	7		$6,941
Solvency Two		1/1/2022	12/31/2026	2,000	60		$112,593
							$490,981
Special payment Requirement	**2022**		**2023**				
Going Concern	9,000		97,860				
Solvency	31,000		24,000				
Total	**40,000**		**121,860**				

(d) Calculate the funded status of the plan on a going concern basis.

Commentary on Question:
Candidates calculated the funded status using the same methodology as part (a), generally making the same mistakes. Some candidates did not reflect the new information provided as at December 31, 2022.

3. **Continued**

Asset Value	914,980

Going concern funding target

Going concern liabilities:

Active members	149,336
Deferred pensioners	317,362
Pensioners	390,000
Subtotal	856,698
PfAD	86,418
Total	**943,116**
Funding excess (shortfall)	**(28,136)**

Member ID	ID2		2020	78,000								
Current age	61		2021	83,000								
Service	6		2022	87,150								
	Age	Years to retirement	Projected earnings	Projected pension	ERF	QxT	QxR	tPxV	Factor (indexed)	Factor (non-indexed)	AL (indexed)	AL (non-indexed)
Age 62	62	1	86,856	10,423	93%	0%	60%	0.9506	16.5	13.5	90,951	74,415
NRD	65	4	97,371	11,684	100%	0%	100%	0.3266	15.3	12.7	58,385	48,463
											149,336	**122,878**

Projected earnings calculation:

- 86,856=AVERAGE(83000,87150,87150*(1+0.0375))
- 97,371=AVERAGE(87150*(1+0.0375)^2,87150*(1+0.0375)^3,87150*(1+0.0375)^4)

tPxV calculation:

- 0.9506= 1/(1+0.052)^1
- 0.3266= (1-0-0.6)/(1+0.052)^4

Deferred:	Indexed AL		Indexed AL = Non Indexed	
	ID3	ID4	ID3	ID4
Age	59	36	59	36
Lifetime pension	25,000	10,000	25,000	10,000
EURA	65	65	65	65
Lifetime factor	15.30	15.30	12.70	12.70
AL	282,187	35,175	234,234	29,198

Pensioner:	Indexed AL		Non-indexed AL	
	ID5 (Spousal)	ID6	ID5 (Spousal)	ID6
Age	71		71	
Spouse Age				
Lifetime pension	31,200		31,200	
Lifetime factor	12.5		10.7	
AL	390,000	0	333,840	0

3. Continued

Determine PfAD			
1) 5.0% for a closed plan			5.00%
2) Provision based on Combined Target Asset Allocation for Non-Fixed Income Assets			7.00%
3) BDR > GC DR			0.00%
PfAD			**12.00%**

(e) Calculate the sources of gain/(loss) of the going concern funded status from December 31, 2021 to December 31, 2022.

Commentary on Question:
Some candidates did not attempt this question and other candidates generally did not perform well.

Funding excess (shortfall) at December 31, 2021	**(744,753)**
PfAD at December 31, 2021	184,479
Funding excess (shortfall) before PfAD	**(560,274)**
Interest on the excess/deficit	(28,014)
Special Payments to fund the deficit with interest	51,235
PfAD contributions with interest	10,007
Net experience gains (losses)	
Investment return	(291,049)
Contributions in excess of accrual	7,247
Salary	(1,754)
Indexation	(7,620)
Mortality	860,331
Termination	(17,021)
Expense experience	14,346
Miscellaneous	5,339
Total experience gains (losses)	**569,819**
Assumption Changes	
Discount Rate	16,022
Salary Scale	(514)
Total assumption change gains (losses)	**15,509**
Funding excess (shortfall) at December 31, 2022 before PfAD	**58,282**
PfAD at December 31, 2022	86,418
Funding excess (shortfall) at December 31, 2022	**(28,136)**

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

Learning Outcomes:
(5k)   The candidate will be able to describe and apply regulation pertaining to coordination of individual and employer sponsored retirement plans.

Sources:
Canadian Pensions and Retirement Income Planning, Willis Towers Watson, 6th Edition, 2017, Chapter 5-12

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Calculate the 2021 Pension Adjustments for all members.

Commentary on Question:
Most candidates were able to score full marks on this part.

- To calculate the benefit entitlement: 0.8%*MIN(salary, $61,600) +1.4%*MAX(0, salary-$61,600). Note that the maximum benefit cannot exceed $3,245.56.

- To calculate PA: benefit entitlement * 9 - $600

EE	Benefit entitlement 2021	2021 PA
#1	610.40	$4,894
#2	3,245.56	$28,610
#3	1,450.40	$12,454
#4	680.40	$5,524
#5	918.40	$7,666
#6	1,240.40	$10,564

(b)   Calculate the 2022 Pension Adjustments for all members.

Commentary on Question:
Some candidates did not annualize the earnings properly before calculating the PA and only received partial points. Many candidates failed to recognize that there would be no PA for #5 since there's only an actuarial increase but no service accrual after 65.

4. **Continued**

EE	Service	Annualized earnings	Benefit entitlement	PA
#1	0.5	$70,000	295.30	$2,058
#3	0.5	$132,000	729.30	$5,964
#6	0.75	$116,000	925.95	$7,734

EE	Reasons why no PA needs to be reported
#2	reached service cap of 35 years - no service accrual, no PA
#4	died - no need to report PA for year of death
#5	over 65 - no service accrual (actuarial increase only), no PA

(c)   Calculate the Pension Adjustment Reversals for 2022.

Commentary on Question:
Some candidates left this part of the question blank. Points were awarded for those who demonstrated knowledge of the formula for a PAR. Many candidates might be unfamiliar with reciprocal transfer agreements and were not able to identify a Specified Distribution correctly.

PAR = A + B - C - D
A   Sum of PAs reported
B   sum of PSPAs reported
C   Specified Distribution
D   PA transfer amount by employer B

Employee #1: A = 4,894 + 2,058 = 6,952, C = 6,500, PAR = 6,952 - 6,500 = 452
Employee #6: A = 48,000, C = 5,420, D = 42,000, PAR = 48,000 – 5,420 – 42,000 = 580

5. **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:

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

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

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

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

Sources:
FR-121-21, ASOP 27, ASOP 35, Determination of Best Estimate Discount Rates for Going Concern Funding Valuations, Selection of Mortality Assumptions for Pension Plan Actuarial Valuations, Expenses in Funding Valuations for Pension Plans, Reflecting Increasing Maximum Pensions Under the Income Tax Act in Solvency, Hypothetical Wind-up and Wind-up Valuations, A Practical Approach to Establishing Margins for Adverse Deviations in Going Concern Funding Valuations, Canadian Pensions and Retirement Income Planning, Willis Towers Watson, 6th Edition, 2017 Ch. 15, Guidance for Assumptions for Hypothetical Wind-up and Solvency Valuations Updated, CIA Ed Note Supplement

Commentary on Question:
Candidates are expected to identify general differences in the purpose of the valuation and valuation methods between going concern and hypothetical wind-up valuations. Candidates are also expected to describe detailed differences in economic and demographic assumptions, identifying differences applicable to specific assumptions. Most candidates did well regarding parts i) and ii), but many failed to provide sufficient detail describing the differences of specific assumptions.
Some candidates incorrectly described the purpose, methods and assumptions used in an actual wind-up valuation instead of a hypothetical wind-up valuation.

5.   Continued

Solution:
Compare and contrast the going concern and hypothetical wind-up valuations with respect to the following:

(i)   Purpose of the valuation;

(ii)   Valuation methods;

(iii)   Economic assumptions; and

(iv)   Demographic assumptions.

i & ii) Purpose of the valuation and valuation methods
Going Concern:
- Estimates plan's obligations on a long-term, going concern basis, using best estimate assumptions recommended by the actuary, and methods and margins consistent with the sponsor's funding policies and the guidelines and constraints established by the regulators.
- Carried out primarily to for the purpose of establishing an appropriate level of contributions to the plan acceptable to the Registered Plans Directorate and the minimum pension standards regulator
- Employ a valuation cost method that results in the orderly accumulation and investment of pension plan assets in order to fund future obligations
- Asset value other than market value can be used for assets in going concern valuation

Hypothetical Wind-up:
- Hypothetical wind-up valuation prepared in conjunction with a funding valuation, but as if the plan had been terminated and all obligations settled as of the valuation date. Hypothetical wind-up valuations are required by minimum standards legislation, but not the Income Tax Act (Canada);
- Attempt to measure what it would cost to settle all the guaranteed benefits of a pension plan at a given point in time. The wind-up liabilities should include contingent benefits (such as grow-in)
- Because a going-concern funding valuation employs a long-term approach – as long as the plan sponsor continues in business and remains prepared to fund any deficits that arise - the exact balance between assets and going concern liabilities may not be very important to plan members and regulators. Full funding of benefit obligations only becomes a real issue when a plan sponsor goes out of business and the plan is fully wound up. For this reason, actuarial standards require actuaries to include an estimate of the hypothetical wind-up liability in any plan prepared for funding purposes.

5. **Continued**

- Obligations are assumed to be settled either through commuted value (typically for those not yet retirement eligible), or annuity purchase (for pensioners and other retirement eligible members).

iii) Economic Assumptions:

Discount Rate

Going Concern:
- Used to develop a long-term compounded annualized expected rate of return on the plan's invested assets. An acceptable approach to developing a going concern discount rate is the building block approach. Typically, a single effective discount rate would be produced/reflected
- Should reflect the plan's specific asset allocation on the valuation date, as well as any future anticipated changes in asset allocation, based on any glidepath strategy or investment policy that may have been formally adopted/implemented. Should be developed using the expected rate of return on the various asset categories, weighted by the plan's target asset allocation. Plus, an additional return related to rebalancing and diversification.
- An alternative approach to the building block approach is to use the yields on high quality fixed income investments, considering expected future benefit payments from the pension plan. The resulting discount rate in this case would be independent of the plan's invested assets.

Hypothetical Wind-up:
- The discount rates to be used are prescribed by the CIA actuarial standards and by provincial legislation, based on the valuation date.
- Discount rates are based on a marked to market approach – reflecting current bond yields
- For benefits assumed to be settled by commuted value, the discount rates (select (applicable for the first 10 years) and ultimate (applicable for all years thereafter) rates) are prescribed by the CIA's commuted value standards applicable at the valuation date. For benefits assumed to be settled by group annuity purchase, the discount rate is to be determined by reference to the group annuity purchase proxy guidance issued quarterly by the CIA. The group annuity purchase discount rate per the guidance would vary depending on the profile (i.e. duration) of the group. The group annuity purchase guidance is developed by the CIA on a quarterly basis, based on actual quotes received from the various insurers on various blocks of hypothetical group annuities.

5. Continued

Inflation

Going Concern:
- Applicable for plans that provide inflation protection by providing cost of living adjustments. Should reflect long-term expectations of inflation.
- Typically, a singular rate is developed, however a select and ultimate rate can be used in situations of transitory higher or lower inflation environments.
- The inflation assumption could be used as a building block component in the development of the wage growth, salary scale, and discount rate assumptions.

Hypothetical Wind-up:
- Similar to discount rates, based on a marked to market approach – reflecting current real return bond yields.
- For benefits assumed to be settled by commuted value, the inflation rates are prescribed by the CIA's commuted value standards applicable at the valuation date (can be reflected explicitly using separate discount rates and inflation rates, or implicitly using a net discount rate). For benefits assumed to be settled by group annuity purchase, inflation is reflected as part of a net discount rate determined by reference to the group annuity purchase proxy guidance issued by the CIA.

Average Wage Growth

Going Concern:
- Applicable to determine income tax act maximums, as well as increases in social security limits for plans with benefit formulas that are integrated with government social security programs, Should reflect long-term expectations of economic growth for the broad economy. The average wage growth assumption would be used as a building block component in the development of a salary scale assumption.

Hypothetical Wind-up:
- Average wage growth can be reflected to project future increases in income tax act maximums for plans that determine maximums based on limits applicable at pension commencement date, as opposed to termination date.

5. **Continued**

Salary Scale

Going Concern:
- Salary scale assumption should reflect the long-term annualized rate of salary increase expected for the plan population.
- Should be developed taking into account historical plan experience and management's expectations for the future
- Should be developed using a building block approach, based on underlying expectation for inflation, general economic growth, and merit/promotion.
- Can use a single effective rate, or have a table of rates varying by age and/or service
- Can develop different increase assumptions for different cohorts/classes of employees.

Hypothetical Wind-up:
- Salary scale is not applicable since the plan is assumed to be terminated on the valuation date.

Plan Expenses

Going Concern:
- Should reflect expectation of ongoing future expenses payable from the plan, taking into account what expenses are paid from the plan vs. directly by the employer. Can be reflected as explicit provision for expenses (in normal cost), or implicitly (net out in discount rate)

Hypothetical Wind-up:
- Allowance for normal administrative, actuarial, legal, and other costs that would be incurred if the plan were to be wound up, deducted from the plan assets / funded status in determining financial position

iv) Demographic Assumptions:

Retirement

Going Concern:
- Retirement assumption should reflect plan specific provisions that may influence individual timing of retirement and pension commencement, and commencement dates of social security programs
- Should reflect characteristics of the group / industry of employer / employer-specific or job-related factors
- Should be developed taking into account historical plan experience and management's expectations for the future

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- Can use a single retirement age or have a table of rates varying by age and/or service.

Hypothetical Wind-up:
- Based on the CIA actuarial standards and by provincial legislation
- For benefits assumed to be settled by group annuity purchase, typically the age that maximizes the value of benefits (optimal age), for benefits assumed to be settled by commuted value, a 50% weight assigned to age that maximizes the value of benefits (optimal age), and 50% weight assigned to earliest unreduced age

Termination

Going Concern:
- Should reflect plan specific provisions that may affect turnover characteristics of the group / industry of employer / employer-specific or job-related factors
- Should be developed taking into account historical plan experience and management's expectations for the future
- Should use a table of rates

Hypothetical Wind-up:
- The plan is assumed to be terminated on the valuation date – therefore all employees are assumed to terminate employment on the valuation date

Disability and Recovery from Disability

Going Concern:
- Should reflect plan specific provisions including definition of disability, that may affect likelihood of disability approval, characteristics of the group / industry of employer / employer-specific or job-related factors, historical plan experience and management's expectations for the future and should consider materiality, including size of plan in assessing whether an assumption should be incorporated

Hypothetical Wind-up:
- The plan is assumed to be terminated on the valuation date, therefore all employees are assumed to terminate employment on the valuation date, and future disability/recovery is not applicable

5.   **Continued**

Mortality and Mortality Improvement

Going Concern:
- Should reflect best estimate mortality assumption for plan population, reflect actual experience, credibility of experience, experience of similar plans, and published mortality tables
- Should also take into account plan specific or employer specific characteristics (blue collar vs white collar), and other characteristics such as pension size as a proxy for socio-economic status
- Future mortality improvement considerations should take into account short-term rate based on recently observed improvement rates, ultimate long-term improvement rate, which is highly uncertain, and transition from short-term to the ultimate improvement rates over certain period. Should give consideration to emerging mortality improvement trends and studies on a regular basis.

Hypothetical Wind-up:
- For benefits assumed to be settled by commuted value, prescribed by the CIA's commuted value standards applicable at the valuation date; For benefits assumed to be settled by annuity purchase, CIA proxy guidance recommends using the CPM2014 base mortality table with improvement scale CPM-B
- Insurers are increasingly considering occupational and demographic factors in establishing mortality assumptions for the pricing basis of specific group annuities, taking into account credibility of experience, experience of similar plans, published mortality studies, plan provisions that expose the group to anti-selection or tail risk, and possible adjustments based on characteristics such as collar type, industry, and pension size.
- An adjustment to regular annuity purchase assumptions would be expected where an insurer might be expected to assume significantly shorter or longer-than-average pension plan longevity

Marital Status

Going Concern:
- Should reflect a married assumption if plan provisions provide different benefits and/or subsidies depending on marital status. Should be developed taking into account historical plan experience and management's expectations for the future. Should also reflect male/female population of plan

5. **Continued**

Hypothetical Wind-up:
- For benefits assumed to be settled by commuted value, should reflect a married assumption if plan provisions provide different benefits and/or subsidies depending on marital status. For benefits assumed to be settled by annuity purchase, would typically reflect the most valuable option form (i.e. reflect 100% married if plan provides a subsidy to married members)
- Similar to going concern, should be developed taking into account historical plan experience and management's expectations for the future. Should also reflect male/female population of plan

6. **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:

Pension Mathematics for Actuaries, Anderson, Arthur W., 3rd Edition, 2006

Commentary on Question:

A well-prepared candidate will be able to calculate unfunded liability and normal cost using the Entry Age Normal cost method. They will also be able to reconcile experience gains/losses in respect of these items.

Solution:

(a)   Calculate the unfunded accrued liability and normal cost of the plan at December 31, 2022.

Commentary on Question:

Candidates generally had some difficulty calculating the unfunded accrued liability and normal cost using the Entry Age Normal cost method, incorporating the multiple decrements. In particular, the decrements (beginning of year) were often not determined correctly.

EAN AL   = PVFB - PVFNC
where EAN NC = $PVFB_w / PVFY_w = PVFB_w / \ddot{a}_{(y-w)\rceil}$

Member A
$PVFB_w$ = 75% x 100 x 12 x (60-27) x $\ddot{a}_{60}^{(12)}$ x v^{33} x .9 x .9
             + 25% x 100 x 12 x (65-27) x $\ddot{a}_{65}^{(12)}$ x v^{38} x .9 x .9
             + 10% x 100 x 12 x (30-27) x $\ddot{a}_{65}^{(12)}$ x v^{38}
             + 10% x 100 x 12 x (31-27) x $\ddot{a}_{65}^{(12)}$ x v^{38} x .9
             = 75x12x33x13.9x.19987x.81 + 25x12x38x12.5x.15661x.81
             + 10x12x3x12.5x.15661 + 10x12x4x12.5x.15661x.9
             = 66,836 + 18,076 + 705 + 845   **= 86,462**

$PVFY_w$ = 75% x .81 x $\ddot{a}_{33\rceil}$ + 25% x .81 x $\ddot{a}_{38\rceil}$ + 10% x $\ddot{a}_{3\rceil}$ + 10% x .9 x $\ddot{a}_{4\rceil}$
             = 75% x .81 x $(1-v^{33})/(1-v)$ + 25% x .81 x $(1-v^{38})/(1-v)$
             + 10% x $(1-v^3)/(1-v)$ + 10% x .9 x $(1-v^4)/(1-v)$

6. Continued

$$= 75\% \times .81 \times 16.8027 + 25\% \times .81 \times 17.7113$$
$$+ 10\% \times 2.8594 + 10\% \times .9 \times 3.7232$$
$$= 10.2076 + 3.5866 + .2859 + .3351 \quad \mathbf{= 14.4152}$$

NC $\quad = 86,462 / 14.4152 \quad\quad\quad\quad \mathbf{= 5,998}$

$PVFB_{2022} \quad = 86,462 \times 1.05^3 \quad\quad\quad\quad \mathbf{= 100,091}$

$PVFNC_{2022} \quad = 5,998 \times (75\% \times .81 \times \ddot{a}_{\overline{30}|} + 25\% \times .81 \times \ddot{a}_{\overline{35}|} + 10\% \times \ddot{a}_{\overline{0}|} + 10\% \times .9 \times \ddot{a}_{\overline{1}|})$
$$= 5,998 \times (75\% \times .81 \times 16.1411 + 25\% \times .81 \times 17.1929 + 10\% \times 0 + 10\% \times .9)$$
$$\mathbf{= 80,237}$$

$AL_{2022} \quad = 100,091 - 80,237 \quad\quad\quad\quad \mathbf{= 19,854}$

Member B

$PVFB_w \quad = 75\% \times 100 \times 12 \times (62-32) \times \ddot{a}_{62}^{(12)} \times v^{30}$
$$+ 25\% \times 100 \times 12 \times (65-32) \times \ddot{a}_{65}^{(12)} \times v^{33}$$
$$= 75 \times 12 \times 30 \times 13.4 \times .23138$$
$$+ 25 \times 12 \times 33 \times 12.5 \times .19987$$
$$= 83,713 + 24,734 \quad\quad\quad\quad \mathbf{= 108,447}$$

$PVFY_w \quad = 75\% \times \ddot{a}_{\overline{30}|} + 25\% \times \ddot{a}_{\overline{33}|}$
$$= 75\% \times (1-v^{30})/(1-v) + 25\% \times (1-v^{33})/(1-v)$$
$$= 75\% \times 16.14107 + 25\% \times 16.80268$$
$$= 12.1058 + 4.2007 \quad\quad\quad\quad \mathbf{= 16.3065}$$

NC $\quad = 108,447 / 16.3065 \quad\quad\quad\quad \mathbf{= 6,651}$

$PVFB_{2022} \quad = 108,447 \times 1.05^{30} \quad\quad\quad\quad \mathbf{= 468,700}$
$PVFNC_{2022} \quad = 6,651 \times (75\% \times \ddot{a}_{\overline{0}|} + 25\% \times \ddot{a}_{\overline{3}|})$
$$= 6,651 \times (75\% \times 0 + 25\% \times 2.8594) \mathbf{= 4,754}$$

$AL_{2022} \quad = 468,700 - 4,754 \quad\quad\quad\quad \mathbf{= 463,946}$

Plan

$NC_{2022} \quad = 90\% \times 5,998 + 25\% \times 6,651 \quad\quad \mathbf{= 7,061}$
$UAL_{2022} \quad = AL - F$
$$= (19,854 + 463,946) - 500,000 \quad\quad \mathbf{= (16,200)}$$

6. Continued

(b) You are given the following for 2023:

- Member B retires on January 1, 2023 and starts receiving a pension from the plan under the normal form.
- A contribution of $10,000 is made to the plan on January 1, 2023.
- The plan's fund earns a rate of return of 10% during 2023.

Calculate the unfunded accrued liability at December 31, 2023.

Commentary on Question:

Some candidates were able to correctly determine the updated assets and accrued liabilities, particularly for Member B. Many of the candidate did not reflect the pension payments made to Member B when calculating the updated asset amounts.

Member A

PVFB_w
$= 75\% \times 100 \times 12 \times (60\text{-}27) \times \ddot{a}_{60}^{(12)} \times v^{33} \times .9$
$+ 25\% \times 100 \times 12 \times (65\text{-}27) \times \ddot{a}_{65}^{(12)} \times v^{38} \times .9$
$+ 10\% \times 100 \times 12 \times (31\text{-}27) \times \ddot{a}_{65}^{(12)} \times v^{38}$
$= 75 \times 12 \times 33 \times 13.9 \times .19987 \times .9 + 25 \times 12 \times 38 \times 12.5 \times .1566 \times .9$
$+ 10 \times 12 \times 4 \times 12.5 \times .15661$
$= 74{,}261 + 20{,}085 + 940$ **= 95,286**

PVFY_w
$= 75\% \times .9 \times \ddot{a}_{\overline{33|}} + 25\% \times .9 \times \ddot{a}_{\overline{38|}} + 10\% \times \ddot{a}_{\overline{4|}}$
$= 75\% \times .9 \times (1\text{-}v^{33})/(1\text{-}v) + 25\% \times .9 \times (1\text{-}v^{38})/(1\text{-}v) + 10\% \times (1\text{-}v^{4})/(1\text{-}v)$
$= 75\% \times .9 \times 16.8027 + 25\% \times .9 \times 17.7113 + 10\% \times 3.7232$
$= 11.3418 + 3.9851 + .3723$ **= 15.6991**

NC $= 95{,}286 / 15.6991$ **= 6,070**

PVFB_{2023} $= 95{,}286 \times 1.05^{4}$ **= 115,821**
PVFNC_{2023} $= 6{,}070 \times (75\% \times .9 \times \ddot{a}_{\overline{29|}} + 25\% \times .9 \times \ddot{a}_{\overline{34|}} + 10\% \times \ddot{a}_{\overline{0|}})$
$= 6{,}070 \times (75\% \times .9 \times 15.8981 + 25\% \times .9 \times 17.0025 + 10\% \times 0)$
= 88,353

AL_{2023} $= 115{,}821 - 88{,}353$ **= 27,468**

Member B
AL_{2023} $= 100 \times 12 \times 30 \times \ddot{a}_{63}^{(12)}$ (i.e., 13.1)   **= 471,600**

6. **Continued**

Plan

F $\quad = (500{,}000+10{,}000) \times 1.1 - (100 \times 12 \times 30) \times 1.05$
[or more precisely, w/mthly int]
$= 561{,}000 - 37{,}800$ $\quad\quad\quad\quad\quad$ **= 523,200**

$UAL_{2023} \quad = AL - F$
$= (27{,}468 + 471{,}600) - 523{,}200$ $\quad\quad\quad$ **= (24,132)**

(c) Calculate the gains and losses by source for 2023.

Commentary on Question:
Some candidates performed reasonably well in this section of the question, many correctly identifying several of the sources of gains/loss. Candidates had the most difficulty when determining the gain/loss in respect of the assets, due to Member B's pension payments. As well, some other candidates did not attempt to reconcile/check the gain/loss.

Exp'd UAL $\quad = (16{,}200) \times 1.05$ $\quad\quad\quad\quad\quad$ **= (17,010)**
Total Gains $\quad = (17{,}010) - (24{,}132)$ $\quad\quad\quad\quad$ **= 7,122**

Gain on contribution:
Gain $\quad\quad = (10{,}000 - 7{,}061) \times 1.05$ $\quad\quad\quad$ **= 3,086**

Gain on fund return:
Exp'd $F_{2023} \quad = (500{,}000 + 10{,}000) \times 1.05 - 36{,}000 \times 1.025$
= 498,600
Gain $\quad\quad = 523{,}200 - 498{,}600$ $\quad\quad\quad\quad$ **= 24,600**

Loss on termination decrement:
Exp'd $AL_{2023} = (19{,}854 + 90\% \times 5{,}998) \times 1.05$ $\quad$ **= 26,515**
Loss $\quad\quad = 26{,}515 - 27{,}468$ $\quad\quad\quad\quad\quad$ **= (953)**

Loss on retirement:
Exp'd $AL_{2023} = (463{,}946 + 25\% \times 6{,}651) \times 1.05 - 36{,}000 \times 1.025$
= 451,989
Loss $\quad\quad = 451{,}989 - 471{,}600$ $\quad\quad\quad\quad$ **= (19,611)**

Check $\quad\quad = 3{,}086 + 24{,}600 + (19{,}611) + (953)$ **= 7,122**

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

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

Sources:
CIA Section 3500 of the Practice-Specific Standards for Pension Plans – Pension Commuted Values (Subsection 3570)

Commentary on Question:
Overall the question was generally well answered, with most candidates demonstrating knowledge of section 3500 of the CIA ASOP and the ability to determine commuted value interest rates and commuted values.

Solution:
(a) Calculate the commuted value discount rates under section 3500 of the Canadian Institute of Actuaries' Standards of Practice as at the members' date of termination.

Commentary on Question:
Candidates had a good understanding of determining non-indexed rates under the new standard. However, most did not correctly calculate the mid-duration real return rate, which resulted in incorrect indexed rates. That issue aside, the question was generally well answered.

See Excel solution

(b) Calculate the commuted values for Member A and Member B at their date of termination assuming the members terminated:

(i) Voluntarily; and

(ii) Involuntarily.

Commentary on Question:
Candidates had good knowledge of grow-in and the retirement assumptions under the new standard. Some candidate had confusion around how the indexation was applied or did not correctly apply the early retirement subsidies in their calculations

See Excel solution

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8.   **Learning Objectives:**

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

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

Learning Outcomes:

(3f)   Calculate actuarially equivalent benefits.

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

Sources:
FR-133-17: Actuarial Equivalence Calculations
Canadian Pensions and Retirement Income Planning, Willis Towers Watson

Commentary on Question:
Candidates in general did not perform well in this question. Common issues were as follows:
- For Part (a), did not perform the test of 60/30/80 points to receive full marks
- For Part (b), not able to determine the correct actuarial equivalent factor for member A; not able to demonstrate the understanding of the concept of level income option for member B; not able to determine the correct increased postponed retirement pension for member C
- For Part (b), did not perform the benefit test with the ITA limit and did not have the final pension amounts converted to monthly to receive full marks

Solution:
(a)   Calculate the maximum lifetime pension that applies to the three members under the Income Tax Act at their respective pension commencement ages.

ITA Limit = DB Limit x Credited Service x ERF
ITA ERF = 0.25% per month from the earlier of:
(i) age 60
(ii) 30 years of svc
(iii) 80 points

As all 3 members are currently over age 60, so all are at unreduced ITA Limit.
As all 3 members have 20 years of credited service, so all have the same ITA Limit.

ITA Monthly DB
Limit   = Annual DB Limit x Credited Service x ERF / 12
                 =3420*20*1/12
                   5,700.00

8. Continued

(b)   Calculate the monthly early retirement pension payable under the elected optional form of payment as at January 1, 2022 for each member.

For Member A
Member terminated under age 55, so will have actuarial equivalent for early retirement reduction.

ERF	= age 61 deferred factor / age 61 immediate factor
	=14.1/17.7
	0.7966

Monthly plan benefit (Normal Form, Life Only)	= 200 x Credited Service x ERF
	=200*20*0.7966
	3,186.40
Monthly plan benefit (Elected Form, Life Only)	= same as normal form
	3,186.40

Benefit test with ITA Limit = min (3,186.40, 5,700)

Monthly plan benefit (Elected Form, Life Only) =   **3,186.40**

For Member B
Calculations below are in
monthly
Let the new monthly lifetime benefits be Y
Let the monthly total bridge benefits (C/QPP + OAS) be Z

Z	=1253.59+642.25
Z	=1,895.84

PV of original lifetime benefits (Normal Form, Life only)
= PV of new lifetime benefits + PV of bridge benefits under level income option

Member terminated employment after age 55 and not yet Age 62
so 3% reduction prior to Age 65 for 4 years for early retirement reduction.

Monthly plan benefit (Normal Form, Life Only)   = 200 x Credited Service x ERF

=200*20*(1-0.03*4)

3,520.00

PV of original lifetime benefits (Normal Form, Life only)
= Monthly plan benefit x age 61 immediate factor
=3520*17.7
 62,304.00

PV of new lifetime benefits + PV of bridge benefits under level income option
= Y x age 61 immediate factor + Z x age 61 immediate bridge factor
=Y*17.7+1895.84*3.6
=17.7Y+6825.02

Y   =(62304-6825.02)/17.7
           3,134.41

Therefore, Y, the new monthly lifetime benefits is not capped at ITA Limit of 5,700.
Bridge benefits provided in lieu of lifetime pension benefits
are not counted for purposes of the combined lifetime and bridge benefits.

Bridge benefits are limited to 40% of the YPME in the year of retirement where they are provided
in lieu of lifetime benefits or 40% x 64,900 /12 = 2,163.33 per month.
Therefore, Z, the monthly total bridge benefits is not capped at limit of
2,163.33.

Therefore, monthly lifetime pension of 3,134.41 is payable
plus a monthly bridge pension of 1,895.84 is payable for the elected Level Income Option.

For Member C
Member terminated over Age 65 and commenced pension 1 year after Age 65 at Age 66,
 so will have 6% increase for one year for 19 years of service accrued before Age 65.

Monthly plan benefit (Normal Form, Life Only)
= 200 x Credited Svc accrued before Age 65 x 1.06 + 200 x Credited Svc accrued after Age 65
=200*19*1.06+200*1
   4,228.00

Monthly plan benefit (Elected Form, Life guaranteed for 10 years)
= Age 66 benefits for Life only x Age 66 immed. factor for Life only / Age 66 immed. factor for L10
=4228*16.1/16.6
  4,100.65

Therefore, the monthly lifetime benefits is not capped at ITA Limit of 5,700.

Monthly plan benefit (Elected Form, Life guaranteed for 10 years) =   **4,100.65**

9.   **Learning Objectives:**

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

Learning Outcomes:

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

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

Sources:

Determination of Best Estimate Discount Rates for Going Concern Funding Valuations, CIA Educational Note, Dec 2015

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)   Calculate the best-estimate going concern discount rate using the building block approach.

    Commentary on question

    Most candidates performed relatively well on this question. The majority of those who did not perform well did not reflect the expenses correctly.

    Both solutions below are appropriate:

    Possible Solution 1: Assuming Passive Management with no extra expense from active management

Risk-free rate	0.96%
Risk premia	2.28%
Value added returns from active management	0.00%
Equity management expenses (passive) fees	-0.10%
Fixed-income management fees	-0.24%
Additional Fees due to active management	0.00%
Diversification and rebalancing	0.20%
Total	**3.10%**

    Possible Solution 2: Assuming Active Management with extra expense from active management

9. **Continued**

Risk-free rate	0.96%
Risk premia	2.28%
Value added returns from active management	0.23%
Equity management expenses (active) fees	-0.10%
Fixed-income management fees	-0.24%
Additional Fees due to active management	-0.03%
Diversification and rebalancing	0.20%
Total	**3.30%**

(b) Describe the consideration for using value added returns from active management when establishing a going concern discount rate.

Commentary on question
Most candidates performed poorly on this question. The majority mentioned that additional returns would have to make up for the additional expenses but that was not sufficient to score points.

The actuary will have to justify, with supporting data, that active return in excess of additional expenses can be consistently and reliably earned over the long term:

- Take into account both historical and future considerations. In order to avoid biases, the actuary would consider periods of both positive and negative incremental returns due to active management. Consider historic performance over different stages of the economic cycle.
- Detailed analysis of a particular manager's organization, people, and investment processes and an assessment of the extent to which past performance and expected future performance can be attributed to these factors.
- Consider the plan's governance processes for hiring, monitoring, and replacement of investment managers.
- Monitor value added at each future valuations and modify or remove the allowance for value added as appropriate.

(c) Describe the other available method for establishing a going concern discount rate and when it would be appropriate to use.

9. **Continued**

Commentary on question
Most candidates performed relatively well on this question. Majority of candidates were able to describe at a high level what the bond yield approach is.

- The fixed-income approach reflects the yields on Government og Canada or high-quality bonds that reasonably matches the plan's projected cash flows or duration.
- Consider allowance for reinvestment and changes in interest rates if fixed-income instruments mature prior to benefit payments.
- Appropriate allowance for expenses should also be made.
- This approach works well for plan whose assets are invested in an immunized portfolio made up of fixed-income instruments that match projected cash flows.