

# RET FRC Model Solutions

## Fall 2021

### 1. Learning Objectives:

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

### Learning Outcomes:

- (1a) Identify data needed.
- (1b) Assess data quality.
- (1c) Make and/or recommend appropriate assumptions where data cannot be provided.
- (1d) Comply with regulatory and professional standards pertaining to data quality.

### Sources:

ASOP 23

Does your pension data need a refresh

CSOP 1440, 1510, 1530

### Commentary on Question:

*Candidates generally did well on part a, but less so on part b. Most candidates discussed the SOP related to disciplinary action, assuming the actuary of Company XYZ had made a mistake in their calculations rather than focusing on the SOP related to Data (CSOP1440), using another Actuary's work (CSOP 1510 and 1530)*

### Solution:

- (a) Identify the data required for each group of membership to verify the liabilities.

The data queries should include the following information as at date of asset transfer for the different groups of members:

Actives members:

- Name/ID number
- Date of birth
- Gender
- Date of hire/date of membership or employment vs pensionable services
- Accrued pension amount at transfer date (monthly or annual)

## 1. Continued

Deferred vested members:

- Name/ID number
- Date of birth
- Gender
- Unreduced retirement date/age and unreduced pension amounts
- Accrued pension amount at normal retirement (monthly or annual)

Retirees and surviving spouse:

- Name/ID number
- Date of birth (retirees and surviving spouse)
- Gender
- Date of retirement
- Date of death for member
- Date of death for surviving spouse, (for joint and last survivor option) if applicable
- Pension forms (JS or LA, with guaranteed period, if applicable)
- Date of birth of spouse (if JS option) and gender
- Pension amount (monthly or annual)

(b) Recommend a course of action, taking into consideration professional standards.

1. The following actions relate to Data (CSOP 1440):

- Perform data check regarding competence and integrity of the data; and assess whether the data are sufficient and reliable.
- For examples,
  - Perform reasonableness check on the data (e.g. are the date of birth/ date of retirement within a reasonable range? Are the pensionable service consistent with the date of membership? Pension payments are consistent with the pension register)
  - Ask for a copy of the latest valuation reports and compare the data/summary statistics.
  - Perform a sanity check of the data based on plan provisions (are the pension amounts consistent with pensionable services? Are the unreduced earliest retirement date/age consistent with the plan provisions?)

2. The following actions relate to the review or repeat of another actuary's work [CSOP 1530]:

- Materiality - You should determine if the discrepancy is material. In this case, the lower liabilities calculated from the other actuary means a smaller asset amount will be transferred and 15% of discrepancy is material. Further investigation is required and notify the client.

## 1. Continued

- You may wish to request for individual liabilities and compare to yours and determine if the discrepancies may be due to an identifiable group of member or due to data error of individual members.
  - Review if the assumptions used by another actuary is appropriate and justifiable for the purpose of the work. The assumptions used are in fact the same as those disclosed.
  - Based on your review of the work (if data issues not being resolved), engage the other actuary and consider whether the interests of the actuary's client or employer and the reviewer's client or employer are opposed.
3. The following actions relate to an actuary's consideration of using another person's work (CSOP 1510):
- An actuary may consider using and taking responsibility for another person's work if such actions are justified. Given the materiality of the discrepancies in this case, you should not use nor take responsibility for another person's work.

## 2. Learning Objectives:

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

### Learning Outcomes:

- (3a) Differentiate between the various purposes for valuing pension plans:
  - (i) Funding
  - (ii) Solvency
  - (iii) Termination/wind-up/conversion
- (3b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using a variety of cost methods.
- (3c) Analyze and communicate the pattern of cost recognition that arises under a variety of funding methods
- (3d) Analyze and communicate the impact on cost stability of a variety of asset valuation methods.
- (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.

### Sources:

CIA Consolidated Standards of Practice, sections 3100-3500

Educational Note: Section 3500 of the Practice-Specific Standards for Pension Plans – Pension Commuted Values (Subsection 3570) - see attached

Educational Note: Section 3500 of the Practice-Specific Standards for Pension Plans – Pension Commuted Values (other than Subsection 3570) - see attached

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

- (i) Calculate the discount rates applicable to commuted value calculations for terminations in January 2022.

## 2. Continued

### Commentary on Question:

Most candidates performed well on this question. Many candidates failed to receive full marks due to one or more of the following.

- Failing to annualize the semi-annual published rates
- Failing to recognize the one-month lag required by the standard
- Incorrectly calculating the spread on provincial and federal bonds – in many cases a spread was not calculated, and the candidate used one of the provincial or federal bond rates in place of the spread
- Final rates were not rounded

Candidate is expected to show the following to get full points:

- Annualize published figures (from December rates):  $(1+i/2)^2-1$

$i_7$ (annualized)	0.48058%
$i_L$ (annualized)	1.24384%
Mid-Term Provincial Bond Index (annualized)	1.10705%
Long-Term Provincial Bond Index (annualized)	2.02010%
Mid-Term Corporate Bond Index (annualized)	1.85149%
Long-Term Corporate Bond Index (annualized)	2.89871%
Mid-Term Federal Non-Agency Bond Index (annualized)	0.61494%
Long-Term Federal Non-Agency Bond Index (annualized)	1.12716%

- Calculate spread components:

$$PS_{1-10} = (\text{FTSE Canada Mid-term Provincial bond index yield, annualized} - \text{FTSE Canada Mid-term Federal non-agency bond index yield, annualized}) = 0.49210\%$$

$$CS_{1-10} = (\text{FTSE Canada Mid-term Corporate bond index yield, annualized} - \text{FTSE Canada Mid-term Federal non-agency bond index yield, annualized}) = 1.23655\%$$

$$PS_{10+} = (\text{FTSE Canada Long-term Provincial bond index yield, annualized} - \text{FTSE Canada Long-term Federal non-agency bond index yield, annualized}) = 0.89294\%$$

$$CS_{10+} = (\text{FTSE Canada Long-term Corporate bond index yield, annualized} - \text{FTSE Canada Long-term Federal non-agency bond index yield, annualized}) = 1.77155\%$$

- Calculate spreads:

$$S_{1-10} = 0,667 * PS_{1-10} + 0,333 * CS_{1-10} = 0.74000\%$$

$$S_{10+} = 0,667 * PS_{10+} + 0,333 * CS_{10+} = 1.18552\%$$

- Calculate the discount rates:

$$i_{1-10} = i_7 + S_{1-10} = 1.22058\% \text{ (1.20\% rounded)}$$

$$i_{10+} = i_L + 0,5 * (i_L - i_7) + S_{10+} = 2.81100\% \text{ (2.80\% rounded)}$$

## 2. Continued

- (ii) Calculate the commuted value for each active member assuming they voluntarily terminated employment on January 1, 2022.

**Commentary on Question:**

*Most candidates performed well on this question, recognizing that members 1 and 2 are not eligible for grow-in (voluntary termination) or bridge benefits, and the result of the CV retirement assumption is age 65.*

Member	1	2
FAE	$= (\$85,000 + \$79,000 + \$75,000) / 3$ $= \$79,666.67$	$= (\$102,000 + \$100,000 + \$97,500) / 3$ $= \$99,833.33$
Benefit	$= 1.25\% \times \text{FAS} \times \text{Years of service}$ $= 1.25\% \times 79,666.67 \times 9 \text{ years}$ $= \$8,962.50$	$= 1.25\% \times \text{FAS} \times \text{Years of service}$ $= 1.25\% \times 99,833.33 \times 11 \text{ years}$ $= \$13,727.08$
Best Age	65	65
EURA	65	65
Factor	8.7	11.3
CV	$= (8.7 \times \$8,962.50 \times 1.0)$ $= \$77,973.75$	$= (11.3 \times \$13,727.08 \times 1.0)$ $= \$155,116.04$

- (iii) Calculate the commuted value for each active member assuming the plan was wound up on January 1, 2022.

**Commentary on Question:**

*Most candidates performed well on this question, recognizing that member 1 did not meet grow-in eligibility and member 2 did meet the 55 point grow-in eligibility requirement.*

Determining grow-in eligibility: Age + service greater than 55 points

- Member 1:  $35 + 9 = 44$  (not eligible for grow-in)
- Member 2:  $45 + 11 = 56$  (eligible for grow-in)

Member 1 CV is same as Part A.

## 2. Continued

Member 2:

Age	Factor (pension)	Factor (bridge)	Reduction (pension)	Commuted value
55	18.5	0	0.85	215,858.39 \$
56	17.6	0	0.88	212,605.07 \$
57	16.9	0	0.91	211,108.81 \$
58	16.1	0	0.94	207,745.68 \$
59	15.3	0	0.97	203,723.64 \$
60	14.6	0	1	200,415.42 \$
61	13.9	0	1	190,806.46 \$
62	13.3	2.1	1	201,050.21 \$
63	12.6	1.4	1	185,281.25 \$
64	12	0.7	1	170,885.00 \$
65	11.3	0	1	155,116.04 \$

Member 2 retirement assumption:

- 50% at age of highest commuted value (age 55) = \$215,858.39
- 50% at age of unreduced pension (age 60) = \$200,415.42

Member 2 CV =  $0.5 \times \$215,858.39 + 0.5 \times \$200,415.42 = 208,136.90$

- (iv) Describe how the calculation of the commuted value would differ if the plan were a target benefit plan in accordance with the Canadian Institute of Actuaries' Standards of Practice.

### Commentary on Question:

*Candidates did not perform as well in this section of the question. In particular, many candidates could only identify some points related to CV calculations differences under a target benefit plan.*

- CVs are calculated using the same going concern assumptions as used in the latest actuarial valuation report or cost certificate filed with applicable pension legislator.
- Going concern assumptions used for the CV calculations would not include any margins or provisions for adverse deviations unless required by applicable legislation or terms of the plan.
- Discount rate would be net of any adjustment for investment expenses.
- Discount rate would be net of any adjustment for non-investment expenses expected to be paid from plan's assets if required by applicable legislation or terms of the plan.

## 2. Continued

- Mortality assumption appropriate for overall plan membership and would not vary for different subsets of plan population (other than age and gender).
- When calculating the CV of a deferred pension, assumptions used would be assumptions that are appropriate for purposes of performing actuarial valuation only for deferred pensioners of the plan (e.g., assumed retirement age of deferreds).
- May be adjusted to reflect funded status of the pension plan only as required by applicable legislation or by the terms of the plan.



### 3. Learning Objectives:

3. The candidate will understand how to apply/synthesize the methods used to value pension benefits for various purposes.
6. The candidate will understand how to apply the regulatory framework in the context of plan funding.

### Learning Outcomes:

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

### Sources:

*Canadian Pensions and Retirement Income Planning*, Willis Towers Watson, 6<sup>th</sup> Edition, 2017

- Ch. 15 (excluding Section 1525)

*Morneau Shepell, Handbook of Canadian Pension and Benefit Plans*, 17<sup>th</sup> Edition, 2020

- Ch. 3 and 6

*Pension Mathematics for Actuaries*, Anderson, Arthur W., 3<sup>rd</sup> Edition, 2006

- Ch. 1-4 and 7

FR-108-13: Pension Funding Exercises (background only)

[Calculation of Incremental Cost on a Hypothetical Wind-Up or Solvency basis](#), CIA Educational Note, Dec 2010

### Commentary on Question:

*Candidates were asked to perform full going concern and wind-up valuations including gain and loss and determination of contributions. 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 total normal cost, going concern liability and the unfunded actuarial liability as at January 1, 2021.

### Commentary on Question:

*Overall this part of the question was done well by candidates. Many candidates struggled with determining the market value of assets as mistaken components were added in or excluded.*

### 3. Continued

<b>Market value of assets</b>	<b>2,911,840</b>	
<b>Going concern funding target</b>		
<b>Going concern liabilities:</b>		
Active members	1,411,749	
Deferred pensioners	94,439	
Pensioners	1,235,257	
Subtotal	2,741,444	
PfAD	274,144	
<b>Total</b>	<b>3,015,589</b>	
<b>Funding excess (shortfall)</b>	<b>(103,749)</b>	
	Without PfAD	With PfAD
<b>Normal cost</b>	<b>57,293</b>	<b>63,022</b>

<b>ACTUAL ASSETS</b>	
1.1.2020 Market Value of Assets	2,500,000
2020 return on assets	300,000
Employer contributions remitted at 12.31.2020	150,000
2020 Benefit Payments with Interest	-38,160
<b>1.1.2021 Market Value of Assets</b>	<b>2,911,840</b>

ACTIVES	Member 1			Termination	Retirement				
	Age			65	60				
	v			0.2955	0.3736				
			3,560	321	3,239		38,871.82		
	Actuarial Liability		249,366	16,519	232,848				
	Normal Cost		19,182						
Proj. Date	Age	Service	Salary	FAE	Bft BOP	Discount	decrement	survival P	PUC
1/1/2018			83,000						
1/1/2019			85,000						
1/1/2020			98,000						
1/1/2021	39	13.00	108,000	88,667	23,053	1.0000	-	1.0000	-
1/1/2022	40	14.00	111,240	97,000	27,160	0.9542	0.10	0.9000	194
1/1/2023	41	15.00	114,577	105,747	31,724	0.9105	-	0.9000	-
1/1/2024	42	16.00	118,015	111,272	35,607	0.8688	-	0.9000	-
1/1/2025	43	17.00	121,555	114,611	38,968	0.8290	-	0.9000	-
1/1/2026	44	18.00	125,202	118,049	42,498	0.7910	-	0.9000	-
1/1/2027	45	19.00	128,958	121,590	46,204	0.7548	-	0.9000	-
1/1/2028	46	20.00	132,826	125,238	50,095	0.7202	-	0.9000	-
1/1/2029	47	21.00	136,811	128,995	54,178	0.6872	-	0.9000	-
1/1/2030	48	22.00	140,916	132,865	58,461	0.6558	-	0.9000	-
1/1/2031	49	23.00	145,143	136,851	62,951	0.6257	-	0.9000	-
1/1/2032	50	24.00	149,497	140,957	67,659	0.5971	0.05	0.8550	127
1/1/2033	51	25.00	153,982	145,185	72,593	0.5697	-	0.8550	-
1/1/2034	52	26.00	158,602	149,541	77,761	0.5436	-	0.8550	-
1/1/2035	53	27.00	163,360	154,027	83,175	0.5187	-	0.8550	-
1/1/2036	54	28.00	168,260	158,648	88,843	0.4950	-	0.8550	-
1/1/2037	55	29.00	173,308	163,407	94,776	0.4723	-	0.8550	-
1/1/2038	56	30.00	178,508	168,309	100,986	0.4507	-	0.8550	-
1/1/2039	57	31.00	183,863	173,359	107,482	0.4300	-	0.8550	-
1/1/2040	58	32.00	189,379	178,560	114,278	0.4103	-	0.8550	-
1/1/2041	59	33.00	195,060	183,916	121,385	0.3915	-	0.8550	-
1/1/2042	60	34.00	200,912	189,434	128,815	0.3736	1.00	0.0000	3,239
1/1/2043	61	35.00	206,939	195,117	136,582	0.3565	-	0.0000	-
1/1/2044	62	36.00	213,147	200,970	144,699	0.3402	-	0.0000	-
1/1/2045	63	37.00	219,542	206,999	153,180	0.3246	-	0.0000	-
1/1/2046	64	38.00	226,128	213,209	162,039	0.3097	-	0.0000	-
1/1/2047	65	39.00	232,912	219,606	171,292	0.2955	-	0.0000	-

### 3. Continued

ACTIVES		Member 2			Termination	Retirement				
	Age				65	60				
	v				0.7202	0.9105				
			2,828		-	2,828				
	Actuarial Liability		1,162,383		-	1,162,383				
	Normal Cost		38,111							
Proj. Date	Age	Service	Salary	FAE	Bft BOP	Discount	decrement	survival P	PUC	
1/1/2018			133,000							
1/1/2019			135,000							
1/1/2020			138,000							
1/1/2021	58.00	30.50	141,000	135,333	82,553	1.0000	-	1.0000	-	
1/1/2022	59	31.50	145,230	138,000	86,940	0.9542	-	1.0000	-	
1/1/2023	60	32.50	149,587	141,410	91,917	0.9105	1.00	0.0000	2,828	
1/1/2024	61	33.50	154,075	145,272	97,332	0.8688	-	0.0000	-	
1/1/2025	62	34.50	158,697	149,630	103,245	0.8290	-	0.0000	-	
1/1/2026	63	35.50	163,458	154,119	109,425	0.7910	-	0.0000	-	
1/1/2027	64	36.50	168,361	158,743	115,882	0.7548	-	0.0000	-	
1/1/2028	65	37.50	173,412	163,505	122,629	0.7202	-	0.0000	-	

INACTIVES									
ID	Status	Age	Ann Bft	NRD	Discount	Factor	AL		
3	Retired	59	36,666	59	1.0000	15.10	553,657		
4	Deferred	45	18,000	65	0.3915	13.40	94,439		
5	Retired	61	24,000	61	1.0000	14.60	350,400		
6	Retired	77	36,000	77	1.0000	9.20	331,200		

CALCULATIONS FOR BENEFIT CHANGES		
MEMBER 3 - ACTIVE TO RETIRED		
	FAE	105,000
	Svc	18.00
	Unreduced Benefit	37,800
	ERD	3%
	Reduced Benefit	36,666
MEMBER 5 - DEFERRED TO RETIRED		
	Unreduced Benefit	24,000
	ERD	0%
	Reduced Benefit	24,000

- (b) Calculate the gains and losses on a going concern basis by source for 2020, excluding PfAD.

#### Commentary on Question:

*This question was overall done poorly by candidates. Many candidates were able to successfully calculate some gain and loss items, however they left off key components and the gain and loss did not balance overall.*

### 3. Continued

<b>Funding excess (shortfall) at January 1, 2020, excluding PfAD</b>		<b>96,000</b>
<b>Sources</b>		
Interest on funding excess (shortfall) before PfAD		4,800
Contributions in excess of accrual		64,950
Investment return		173,740
Salary		(8,346)
Retirement		(81,557)
Mortality		(6,000)
Miscellaneous		(299)
Impact of changes in assumptions		(72,893)

<b>Funding excess (shortfall) at January 1, 2021, excluding PfAD</b>		<b>170,396</b>	
	Liabilities	Assets	Gain / (Loss)
<b>1.1.2020</b>	<b>2,404,000</b>	<b>2,500,000</b>	<b>96,000</b>
Normal Cost/Employer Contributions	85,050	150,000	64,950
Benefit Payments	(36,000)	(36,000)	-
Interest	119,300	124,100	4,800
Salary Experience	8,346		(8,346)
Mortality Experience	6,000		(6,000)
Retirement Expense	81,557		(81,557)
Discount Rate Change	72,893		(72,893)
Investment Return		173,740	173,740
Misc	299		(299)
<b>1.1.2021</b>	<b>2,741,444</b>	<b>2,911,840</b>	<b>170,396</b>

G/L by individual	Expected	Actual		
- Mem1	(219,450)	(234,659)	(15,209)	salary
- Mem2	(1,141,350)	(1,134,487)	6,863	salary
- Mem3	(543,900)	(542,657)	1,243	retirement
- Mem4	(89,250)	(89,549)	(299)	misc - rour
- Mem5	(260,400)	(343,200)	(82,800)	retirement
- Mem6	(318,000)	(324,000)	(6,000)	mortality
Check	(2,572,350)	(2,668,552)	(96,202)	

### 3. Continued

ACTIVES		Member 1			Termination	Retirement				
	Age				65	60				
	v				0.2812	0.3589				
				3,560	321	3,239				
	Actuarial Liability			234,659	15,485	219,174				
	Normal Cost			18,051						
Proj. Date	Age	Service	Salary	FAE	Bft BOP	Discount	decrement	survival P	PUC	
1/1/2018			83,000							
1/1/2019			85,000							
1/1/2020			98,000							
1/1/2021	39		108,000		88,667	23,053	1.0000	-	1.0000	-
1/1/2022	40		111,240		97,000	27,160	0.9524	0.10	0.9000	194
1/1/2023	41		114,577		105,747	31,724	0.9070	-	0.9000	-
1/1/2024	42		118,015		111,272	35,607	0.8638	-	0.9000	-
1/1/2025	43		121,555		114,611	38,968	0.8227	-	0.9000	-
1/1/2026	44		125,202		118,049	42,498	0.7835	-	0.9000	-
1/1/2027	45		128,958		121,590	46,204	0.7462	-	0.9000	-
1/1/2028	46		132,826		125,238	50,095	0.7107	-	0.9000	-
1/1/2029	47		136,811		128,995	54,178	0.6768	-	0.9000	-
1/1/2030	48		140,916		132,865	58,461	0.6446	-	0.9000	-
1/1/2031	49		145,143		136,851	62,951	0.6139	-	0.9000	-
1/1/2032	50		149,497		140,957	67,659	0.5847	0.05	0.8550	127
1/1/2033	51		153,982		145,185	72,593	0.5568	-	0.8550	-
1/1/2034	52		158,602		149,541	77,761	0.5303	-	0.8550	-
1/1/2035	53		163,360		154,027	83,175	0.5051	-	0.8550	-
1/1/2036	54		168,260		158,648	88,843	0.4810	-	0.8550	-
1/1/2037	55		173,308		163,407	94,776	0.4581	-	0.8550	-
1/1/2038	56		178,508		168,309	100,986	0.4363	-	0.8550	-
1/1/2039	57		183,863		173,359	107,482	0.4155	-	0.8550	-
1/1/2040	58		189,379		178,560	114,278	0.3957	-	0.8550	-
1/1/2041	59		195,060		183,916	121,385	0.3769	-	0.8550	-
1/1/2042	60		200,912		189,434	128,815	0.3589	1.00	0.0000	3,239
1/1/2043	61		206,939		195,117	136,582	0.3418	-	0.0000	-
1/1/2044	62		213,147		200,970	144,699	0.3256	-	0.0000	-
1/1/2045	63		219,542		206,999	153,180	0.3101	-	0.0000	-
1/1/2046	64		226,128		213,209	162,039	0.2953	-	0.0000	-
1/1/2047	65		232,912		219,606	171,292	0.2812	-	0.0000	-

  

ACTIVES		Member 2			Termination	Retirement				
	Age				65	60				
	v				0.7107	0.9070				
				2,828	-	2,828				
	Actuarial Liability			1,134,487	-	1,134,487				
	Normal Cost			37,196						
Proj. Date	Age	Service	Salary	FAE	Bft BOP	Discount	decrement	survival P	PUC	
1/1/2018			133,000							
1/1/2019			135,000							
1/1/2020			138,000							
1/1/2021	58	30.50	141,000		135,333	82,553	1.0000	-	1.0000	-
1/1/2022	59	31.50	145,230		138,000	86,940	0.9524	-	1.0000	-
1/1/2023	60	32.50	149,587		141,410	91,917	0.9070	1.00	0.0000	2,828
1/1/2024	61	33.50	154,075		145,272	97,332	0.8638	-	0.0000	-
1/1/2025	62	34.50	158,697		149,630	103,245	0.8227	-	0.0000	-
1/1/2026	63	35.50	163,458		154,119	109,425	0.7835	-	0.0000	-
1/1/2027	64	36.50	168,361		158,743	115,882	0.7462	-	0.0000	-
1/1/2028	65	37.50	173,412		163,505	122,629	0.7107	-	0.0000	-

  

INACTIVES								
ID	Status	Age	Ann Bft	NRD	Discount	Factor	AL	
3	Retired	59	36,666	59	1.0000	14.80	542,657	
4	Deferred	45	18,000	65	0.3769	13.20	89,549	
5	Retired	61	24,000	61	1.0000	14.30	343,200	
6	Retired	77	36,000	77	1.0000	9.00	324,000	

### 3. Continued

- (c) Calculate the solvency funded position as at January 1, 2021.

**Commentary on Question:**

*Overall candidates did well on this part of the question. Note some candidates did not test for grow-in on the active members and some did not apply the new December 1, 2020 Commuted Value Standard.*

<b>Net assets</b>	<b>2,861,840</b>
<b>Present value of accrued benefits for:</b>	
Active members	1,899,725
Deferred pensioners	216,000
Pensioners	1,659,253
<b>Total solvency liability</b>	<b>3,774,977</b>
<b>Solvency excess (shortfall)</b>	<b>(913,137)</b>

MEMBER	1	2	3	4	5	6
Status	Active	Active	Retired	Deferred	Retired	Retired
Bft	23,053	82,553	36,666	18,000	24,000	36,000
Pts	52	88.5				
Grow in?	FALSE	TRUE				
SVC?	TRUE	TRUE				
EURD	65	60				
MAX	10.60	20.30				
Opt Age	65	58				
Age	w/ Red	w/ Red				
55	6.60	-				
56	7.31	-				
57	7.90	-				
58	8.47	20.30				
59	8.96	20.08				
60	9.38	19.80				
61	9.73	18.90				
62	10.09	18.10				
63	10.30	17.20				
64	10.53	16.40				
65	10.60	15.70				
Solvency Liability	244,365.33	1,655,359	773,653	216,000	482,400	403,200

- (d) Calculate the 1-year Solvency Incremental Cost.

**Commentary on Question:**

*Overall this part of the question was done well by candidates. Many candidates struggled with discounting the projected actuarial liabilities.*

### 3. Continued

Solvency incremental cost		(59,005)
Blended Solvency DR	2.2%	
	2021	2022
Projected AL	3,774,977	3,700,000
AL at val date	3,774,977	3,620,352
Exp. Benefit	95,620	
SIC	(59,005)	

- (e) Calculate the minimum required and maximum permissible employer contributions for 2021 and the minimum required special payments for 2022.

#### Commentary on Question:

Many Candidates were able to correctly calculate the maximum contributions for 2021. Candidates struggled with determining the special payments with respect to both 2021 and 2022.

Minimum required contributions for 2021		356,848
Minimum required special payments for 2022		11,265
Maximum permissible contributions for 2021		976,160
	<b>2021</b>	
Normal cost	57,293	
PfAD on normal cost	5,729	
Special payments		
<i>Going Concern</i>	19,000	
<i>Solvency</i>	274,825	
Minimum annual contribution	356,848	
Maximum annual contribution	976,160	

Prior amortization schedules				1/1/2021	1/1/2021
Type	Monthly Amortization Payment (\$000s)	Date Established	Date of Last Payment	Solv PV	GC PV
Going concern	1,583	1/1/2021	12/31/2022	18,776	18,515
Going concern	939	1/1/2022	12/31/2031	53,290	85,234
Solvency	21,917	1/1/2021	12/31/2025	1,244,177	
Solvency	4,167	1/1/2020	12/31/2024	191,285	
				1,507,527	

Solvency assets		2,911,840	2,911,840
PV GC SP		72,065	72,065
PV Solv SP		1,435,462	-
Termination Expense		(50,000)	(50,000)
Solvency liabilities		3,774,977	3,774,977
Reduced Solvency deficiency (85% ratio):		-	274,825

All solvency special payments cannot be eliminated but amortization period can be shortened so the reduced solvency excess moves to zero

### 3. Continued

- (f) Develop the plausible adverse scenario disclosure as at January 1, 2021.

**Commentary on Question:**

*This question was omitted or partially done by most candidates.*

	Going concern	Deterioration of		
	results	Interest rate risk	asset values	Longevity risk
Market value of assets	2,911,840	3,028,314	2,693,452	2,911,840
Going concern liability	2,741,444	2,926,143	2,741,444	2,878,517
PfAD	274,144	292,614	274,144	287,852
Going concern funding target	3,015,589	3,218,757	3,015,589	3,166,368
Funding excess (shortfall)	(103,749)	(190,443)	(322,137)	(254,528)
Current service cost including PfAD	63,022	68,751	63,022	66,173

<b>Interest Rate Risk</b>		
Duration of Asset Portfolio	8.00	
Fixed income allocation	50%	
<b>Market value of assets</b>	<b>3,028,314</b>	<b>=2,911,840*(1-8*-1%*0.5)</b>
GC AL duration	13.47	
<b>Going concern liability</b>	<b>2,926,080</b>	<b>=2,741,444*(1-13.47*-0.5%)</b>
GC NC duration	18.18	
Current service cost	62,501	=57,293*(1-18.18*-0.5%)
<b>Current service cost including PfAD</b>	<b>68,751</b>	

<b>Deterioration of asset values</b>		
<b>Market value of assets</b>	<b>2,693,452</b>	<b>=2,911,840*(1-0.5*15%)</b>
<b>Going concern liability</b>	2,741,444	no change
<b>Current service cost including PfAD</b>	63,022	no change

<b>Longevity risk</b>		
<b>Market value of assets</b>	2,911,840	no change
Impact of longevity increase on AL & NC	5%	
<b>Going concern liability</b>	<b>2,878,517</b>	<b>=2,741,444*(1+5%)</b>
Current service cost	60,158	=57,293*(1+5%)
<b>Current service cost including PfAD</b>	<b>66,173</b>	



#### **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:**

- (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.
- (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:**

ASOP 35: Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations

CIA Rules of Professional Conduct

#### **Commentary on Question:**

*The question was not answered well by most of the candidates. Most candidates did not refer to any specific standards of practice in part b) and lost points. Many candidates also did not describe why the assumptions do not meet the standards.*

#### **Solution:**

- (a) Describe the considerations for setting a retirement rates assumption.

The actuary should take into account factors such as the following:

- employer-specific or job-related factors such as occupation, employment policies, work environment, unionization, hazardous conditions, and location of employment;
- the plan design, where specific incentives may influence when participants retire;
- the design of, and anticipated payment from, social insurance programs (for example, Social Security or Medicare); and

## 4. Continued

- the availability of other employer-sponsored postretirement benefit programs (for example, postretirement health coverage or savings plan).

The actuary should also consider:

- **Materiality** – The actuary should take into account the balance between refined demographic assumptions and materiality (the actuary should use professional judgement if the use of more refined assumptions is not expected to produce materially different results).
- **Cost of Using Refined Assumptions** – The actuary should take into account the balance between refined demographic assumptions and the cost of using refined demographic assumptions.
- **Combined Effect of Assumptions** – The combined effect of all nonprescribed assumptions selected by the actuary (both demographic assumptions selected in accordance with this standard and economic assumptions selected in accordance with ASOP No. 27) should be reasonable. For example, the actuary may have decided not to make any assumption with regard to four different types of future events, each of which alone is immaterial. However, the effect of omitting assumptions for all four types of future events may be a material understatement or overstatement of the measurement results.
- **Changes in circumstance** – The demographic assumptions selected should reflect the actuary’s knowledge as of the measurement date. However, the actuary may learn of an event occurring after the measurement date, that would have changed the actuary’s selection of a demographic assumption. If appropriate, the actuary may reflect this change as a subsequent event as of the measurement date.
- **Views of experts** – Demographic data and analyses are available from a variety of sources, including representatives of the plan sponsor and administrator, demographers, economists, and other professionals. When the actuary is responsible for selecting or giving advice on selecting demographic assumptions within the scope of this standard, the actuary may incorporate the views of experts, but the selection or advice should reflect the actuary’s professional judgment.

#### 4. Continued

(b) You are the actuary for a plan with the following provisions:

Normal Retirement Age:	65
Normal Retirement Benefit:	Monthly benefit of \$60 per year of credited service
Earliest Retirement Age:	55
Early Retirement Benefit:	Unreduced at Age 60 Reduced by 3% for each year by which retirement precedes age 60
Bridge Benefit:	Monthly benefit of \$20 per year of credited service Payable from Early Retirement Age to Age 65

The company that sponsors the plan has asked you to use the following retirement assumption:

Age	Probability of Retirement
62	50%
65	100%

Critique the company's proposed retirement assumption, referencing the applicable professional standards.

The professional standards that apply to this situation are:

- Rule 1 - Professional integrity. A member shall act honestly, with integrity and competence, and in a manner to fulfil the profession's responsibility to the public and to uphold the reputation of the actuarial profession.
- Rule 3 - Standards of Practice. A member shall ensure that professional services performed by or under the direction of the member meet applicable standards of practice.
- Rule 6 - Control of work product. A member who performs professional services shall take reasonable steps to ensure that such services are not used to mislead other parties or to violate or evade the law.

In general the retirement assumption should:

- reflect the actuary's professional judgment.
- take into account actual plan experience relevant as of the measurement date but would not necessarily have to reflect current conditions persisting into the future.

## 4. Continued

- reflect the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof.

In particular, with respect to the company's proposed retirement assumption:

- May not be appropriate to change to a retirement age of 65 when members are entitled to unreduced pension at 60 with a bridge benefit
- The 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

## 5. Learning Objectives:

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

### Learning Outcomes:

- (5c) The candidate will be able to describe and apply regulation pertaining to plan amendment.
- (5h) The candidate will be able to describe and apply regulation pertaining to members' rights.
- (5i) The candidate will be able to describe and apply regulation pertaining to contributions and benefits.

### Sources:

Canadian Pensions and Retirement Income Planning, Willis Towers Watson – Chpt. 17

### Commentary on Question:

*Part A was generally not well answered. It was apparent most candidates had not read this particular study not as they were not able to describe the requirements under the CRA for a special downsizing program or the additional benefits that may be granted under such a program.*

*Candidates did much better on part b, and generally understood what ancillary benefits could be changed, and to what extent under the ITA, to improve the value of benefits without generating a PSPA.*

### Solution:

- (a) Describe the CRA's special downsizing program requirements and the additional benefits that may be provided.

CRA's special downsizing program requirements :

- Program must result in a net reduction of the greater of 50 employees or 10% of employees
- Reduction must be met within 2 years (i.e. program cannot span more than 2 years)
- Benefits under the program must commence within two years of program approval
- The program must be non-discriminatory -> benefit improvements cannot favor high-paid employees
- Targeted group may consist of no more than 35% in top earnings quartile
- No employees within the targeted group may continue to provide services to the company

## 5. Continued

- Any additional benefit under the downsizing program must not be paid as a lump-sum

Additional benefit that can be offered under a downsizing program:

- Eligibility: Members aged 55 and over at termination
- Additional service: lesser of 7 years number of years from termination date to age 65
- Accrual Rate: **for additional service described** above, lesser of the maximum pension under the Income Tax Act (ITA) in the year of termination and 2% of the member's Final 3-year Average Earnings
- Indexation: additional benefit as determined above indexed at 100% of CPI
- Unreduced benefits at the lesser of 25 years of service; or age 55; or 75 points, and reduced 3% per year to the above

- (b) Recommend changes to the provisions that meet the client's goals but do not require the approval of a special downsizing program.

Current provisions can be amended to enhance benefits which do not create a PSPA and do not require qualifying for a special downsizing program are:

- Enhancing the early retirement reduction– unreduced retirement at earlier of age 60, 30 years of service or 80 points
- Enhance the Plan's FAE to FAE3
- Provide post retirement indexation of up to 100% of CPI
- Enhance the normal form of payment
  - Single: life and guaranteed for 180 payments
  - Married: Joint and survivor 66 and 2/3 guarantee for 5 year
- Offer a bridge benefit– up to CPP plus OAS

## 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:

- (3b) Perform periodic valuations of ongoing plans, calculating normal cost and actuarial liability, using a variety of cost methods.
- (5h) The candidate will be able to describe and apply regulation pertaining to members' rights.

## Sources:

Pension Mathematics for Actuaries (Anderson)

FR-132-17 Chapter 5 of *A Problem-Solving Approach to Pension Funding and Valuation*, Second Edition

## Commentary on Question:

*Parts a) and b) were answered well by candidates that were familiar with the cost method. Some candidates were not familiar with the cost method and did poorly as a result. Almost all candidates were not able to determine the gain/loss in part c) and as a result scored poorly in this part.*

## Solution:

- (a) Calculate the unfunded actuarial liability and the total normal cost as at January 1, 2021.

Show all work.

$$\begin{aligned} \text{AAN UAL}_{\text{initial}} &= \text{UC UAL}_{\text{initial}} \\ \text{AAN NC}_t &= (\sum \text{PVFB}_t - \text{AL}_t) / \sum \text{PVFY}_t \times n \end{aligned}$$

### Member A

$$\begin{aligned} \text{PVFB} &= 100 \times 12 \times (60-30) \times \ddot{a}_{60}^{(12)} \times v^{(60-43)} \times .95^2 + \\ &\quad 100 \times 12 \times 13 \times \ddot{a}_{60}^{(12)} \times v^{(60-43)} \times .05 + \\ &\quad 100 \times 12 \times 14 \times \ddot{a}_{60}^{(12)} \times v^{(60-43)} \times .95 \times .05 \\ &= 1200 \times 30 \times 14.8 \times .4363 \times .95^2 + \\ &\quad 1200 \times 13 \times 14.8 \times .4363 \times .05 + \\ &\quad 1200 \times 14 \times 14.8 \times .4363 \times .95 \times .05 \\ &= 219,983 \\ \text{PVFY} &= .95 + .95^2 / 1.05 \times \ddot{a}_{60-44} \\ &= .95 + .95^2 / 1.05 \times 11.3797 \\ &= 10.7311 \end{aligned}$$

## 6. Continued

$$\begin{aligned} \text{UC AL} &= 1200 \times 13 \times 14.8 \times .4363 \\ &= 100,732 \end{aligned}$$

### Member B

$$\begin{aligned} \text{PVFB} &= 100 \times 12 \times (60-35) \times \ddot{a}_{60}^{(12)} \times v^{(60-50)} \\ &= 1200 \times 25 \times 14.8 \times .61391 = 272,577 \\ \text{PVFY} &= \ddot{a}_{60-50} \overline{] = 8.1078} \\ \text{UC AL} &= 1200 \times 15 \times \ddot{a}_{60}^{(12)} \times v^{(60-50)} \\ &= 1200 \times 15 \times 14.8 \times .61391 = 163,546 \end{aligned}$$

### Member C

$$\begin{aligned} \text{PVFB} &= 100 \times 12 \times (60-40) \times \ddot{a}_{60}^{(12)} \times v^{(60-59)} \\ &= 1200 \times 20 \times 14.8 \times .95238 = 338,286 \\ \text{PVFY} &= \ddot{a}_{60-59} \overline{] = 1} \\ \text{UC AL} &= 1200 \times 19 \times \ddot{a}_{60}^{(12)} \times v^{(60-59)} \\ &= 1200 \times 19 \times 14.8 \times .95238 = 321,371 \end{aligned}$$

$$\begin{aligned} \sum \text{PVFB}_{2021} &= 219,983 + 272,577 + 338,286 &= 830,846 \\ \sum \text{PVFY}_{2021} &= 10.7311 + 8.1078 + 1 &= 19.8389 \\ \text{UC AL}_{2021} &= 100,732 + 163,546 + 321,371 &= 585,649 \end{aligned}$$

$$\begin{aligned} \text{AAN UAL}_{2021} &= \text{UC UAL}_{2021} \\ &= \text{UC AL}_{2021} - F_{2021} \\ &= 585,649 - 0 &= 585,649 \end{aligned}$$

$$\begin{aligned} \text{AAN NC}_{2021} &= (\sum \text{PVFB}_{2021} - \text{AL}_{2021}) / \sum \text{PVFY}_t \times n \\ &= (830,846 - 585,649) / 19.8389 \times 3 \\ &= 37,078 \end{aligned}$$

- (b) Calculate the unfunded actuarial liability and the total normal cost as at January 1, 2022.

Show all work.

### Member A

$$\begin{aligned} \text{PVFB} &= 100 \times 12 \times (60-30) \times \ddot{a}_{60}^{(12)} \times v^{(60-44)} \times .95 + \\ &\quad 100 \times 12 \times 14 \times \ddot{a}_{60}^{(12)} \times v^{(60-44)} \times .05 \\ &= 1200 \times 30 \times 14.8 \times .4581 \times .95 + \\ &\quad 1200 \times 13 \times 14.8 \times .4581 \times .05 \\ &= 237,573 \end{aligned}$$



## 6. Continued

$$\begin{aligned} \text{PVFY} &= .95 \times \ddot{a}_{60-44} \\ &= .95 \times 11.3797 &= 10.8107 \end{aligned}$$

### Member B

$$\begin{aligned} \text{PVFB} &= 100 \times 12 \times (60-35) \times \ddot{a}_{60}^{(12)} \times v^{(60-51)} \\ &= 1200 \times 25 \times 14.8 \times .6446 &= 286,206 \\ \text{PVFY} &= \ddot{a}_{60-51} &= 7.4632 \end{aligned}$$

### Member C

$$\begin{aligned} \text{PVFB} &= 100 \times 12 \times (61-40) \times \ddot{a}_{60}^{(12)} \times v^{(60-59)} \\ &= 1200 \times 21 \times 14.5 \times .95238 = 348,000 \\ \text{PVFY} &= \ddot{a}_{60-59} &= 1 \end{aligned}$$

$$\begin{aligned} \sum \text{PVFB}_{2022} &= 237,573 + 286,206 + 348,000 &= 871,779 \\ \sum \text{PVFY}_{2022} &= 10.8107 + 7.4632 + 1 &= 19.2739 \end{aligned}$$

$$F_{2022} = 150,000 * 1.0 = 150,000$$

$$\begin{aligned} \text{AAN UAL}_{2022} &= \text{Expected AAN AL}_{2022} \\ &= (\text{AAN AL}_{2021} + \text{AAN NC}_{2021}) \times 1.05 - 2021 \text{ Contributions w/int} \\ &= (585,649 + 37,078) \times 1.05 - 150,000 \times 1.0 \\ &= 503,864 \end{aligned}$$

$$\begin{aligned} \text{AAN AL}_{2022} &= \text{AAN UAL}_{2022} + F_{2022} \\ &= 503,864 + 150,000 &= 653,864 \end{aligned}$$

$$\begin{aligned} \text{AAN NC}_{2022} &= (\sum \text{PVFB}_{2022} - \text{AL}_{2022}) / \sum \text{PVFY}_{2022} \times n \\ &= (871,779 - 653,864) / 19.2739 \times 3 \\ &= 33,919 \end{aligned}$$

- (c) Calculate the impact of demographic experience, by source, between January 1, 2021 and January 1, 2022, on the normal cost **per active member**.

Show all work.

### Increase in per member normal cost due to termination experience (Member A):

$$\begin{aligned} \text{Exp'd PVFB}_{2022} &= 219,983 \times 1.05 = 230,982 \\ \text{Act'l PVFB}_{2022} &= 237,573 \\ \text{Exp'd PVFY}_{2022} &= .95^2 \times \ddot{a}_{60-44} = 10.2702 \\ \text{Act'l PVFY}_{2022} &= 10.8107 \\ \text{Exp'd NC}_{2022} &= (871,779 + (230,982 - 237,573) - 653,864) / \\ &\quad (19.2739 + (10.2702 - 10.8107)) \\ &= 211,324 / 18.7334 = 11,281 \end{aligned}$$

## 6. Continued

$$\begin{aligned}\text{Act'l NC}_{2022} \text{ per mbr} &= 33,919 / 3 = 11,306 \\ \text{Experience Loss} &= 11,306 - 11,281 = 25\end{aligned}$$

### Decrease in per member normal cost due to retirement experience (Member C):

$$\begin{aligned}\text{Exp'd PVFB}_{2022} &= 338,286 \times 1.05 = 355,200 \\ \text{Act'l PVFB}_{2022} &= 348,000 \\ \text{Exp'd PVFY}_{2022} &= 0 \text{ (assumed to retire)} \\ \text{Act'l PVFY}_{2022} &= 1 \text{ (assumed to retire 1 year later)} \\ \text{Exp'd NC}_{2022} &= (211,324 + (355,200 - 348,000)) / \\ &\quad (18.7334 + (0 - 1)) \\ &= 12,323 \\ \text{NC (incl term'n exp)} &= 11,281 \\ \text{Experience Gain} &= 12,323 - 11,281 = 1,042\end{aligned}$$

## 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:

FR-139-18: OECD Core Principles of Private Pension Regulation

Ontario Pension Benefit Act

### Commentary on Question:

*Many candidates had difficulty answering this question. In particular, many candidates could only identify some points related to the PBA, but few candidates listed points related to Core Principle 7.*

### Solution:

Compare and contrast the principles set out in Core Principle 7 of the OECD Core Principles of Private Regulations against the established framework for defined benefit pension plans regulated by the Pension Benefits Act (Ontario) and the Income Tax Act (Canada) for the following:

- (i) Measurement of pension plan liabilities;
  - (ii) Funding requirements of pension plans, and the treatment of surpluses or deficits; and
  - (iii) Wind-up or termination of pension plans.
- (i) Measurement of pension plan liabilities;
- Core Principle 7:
    - The plan's liabilities be calculated at least once every three years by an actuary or an equivalent specialist with required competency in pension.
    - A certification or report of the adjusted development of the liability and changes in risks covered is required for the intervening years.
    - The ongoing liability should take into account the projected benefits to be received with plan eligibility and vesting requirement met at the time of retirement, mortality and withdrawal decrements.
    - The termination liability should reflect the pension benefits payable if the plan terminates at the time of the valuation with the accrual of further entitlement ceased.

## 7. Continued

- The termination liability equals the cost of the benefits payable at the time the plan winds up, such as the cost of purchasing annuities or payment of lump sums, plus the cost of termination.
  - Both ongoing and termination liability should reflect benefit indexation factors prescribed by law or the plan terms.
  - Takes into account liabilities over time in relation to current and future years (ongoing liability) to assure that pension assets match this potential ongoing liability as it accrues and matures over time.
  - Requires that the calculation method includes a prudent funding method, amortization rules and demographic, behavioral and economic assumptions that are considered appropriate and consistent with the generally required recognized actuarial standards.
  - The use of prudent discount rates for determining the ongoing and termination liabilities, which are consistent with market conditions and are compatible with the methodologies used in the valuation of assets and other economic assumptions.
  - Legal provision or actuary profession should provide guidance on the discount rate and assumption setting.
  - Allows additional level of prudence if using established methods creates an unacceptable risk to member benefits.
- PBA/ITA:
    - Actuary prepares triennial actuarial valuations using methods and actuarial assumptions that are consistent with accepted actuarial practice. Plans less than 85% funded on solvency basis requires annual actuarial valuation. A cost of certificate is required for the intervening year when plan is applying surplus for contribution holiday.
    - The valuation must be completed both on a solvency basis, under which assets and liabilities are valued as if the plan is terminated on the date of the valuation, and on a going concern basis, under which valuation proceeds on the assumption that the plan will continue indefinitely.
    - There is no statutory compulsion to provide inflation protection in the form of indexing (ad hoc indexing is more common for private sector defined benefit plan).
    - Requires the provision of adverse deviation (PfAD) in the going concern liability to create an explicit funding cushion, but at a lower required funding level under solvency.
    - A solvency deficiency can be amortized over a five-year period, while a going concern unfunded liability can be amortized over a 10-year period.
    - Going concern assumptions are selected by actuary while solvency assumptions are largely prescribed based on the market conditions on valuation date.

## 7. Continued

- (ii) Funding requirements of pension plans, and the treatment of surpluses or deficits; and
- Pension plans are required to maintain a level of assets that equal to the target funding level after factoring the operational plan cost.
  - The legal separation of pension plan assets should be mandatory as a minimum level of protection for the pension assets. Pension plan should be funded through the establishment of a pension fund.
  - Plan sponsors should be subject to minimum funding rules or other mechanisms to ensure adequate funding of pension liabilities. The pension fund is usually held by a trust company or insurance company.
  - PBA/ITA:
    - Must be funded; the plan's assets must be sufficient to pay for its going concern deficiency up to 100% of the liability, and fund solvency deficiency up to 85% of solvency liabilities through special payments.
    - Sets permissible benefits, maximums on tax-deductible contributions, and maximum limits on pension amounts.
    - Contributions and investment earnings for registered pension plans are tax-exempt until such time as benefits commence to be paid.
    - Surplus can be applied toward required employer/member contributions, provided that the plan remains fully funded on a going concern basis and maintains a transfer ratio of at least 105%. Surplus above this level is considered "available actuarial surplus" and can be used to allow employers to take a contribution holiday.
    - A solvency deficiency can be amortized over a five-year period, while a going concern unfunded liability can be amortized over a 10-year period.
  - Core Principle 7:
    - Allows for flexibility in the targeted funding level, which may be based on the termination liabilities or the ongoing liabilities.
    - The funding target should balance the need for benefit security and the affordability of the pension provision; should take account of the plan sponsor's ability to increase contribution and the possibility of adjusting benefit provisions in the case of underfunding.
    - Tax regulations should not discourage the build-up of sufficient reserves to withstand adverse market conditions and should avoid restricting the full funding, but does not have specific restrictions on minimum or maximum contribution levels.
    - Temporary suspension of contribution obligations, benefit increases, or a return of the surplus to the plan sponsor should only be permitted in circumstances of high levels of overfunding
    - The approved funding method for the ongoing liability may reduce volatility in the funding contribution level by spreading the funding of the liability over the expected working life of plan members.

## 7. Continued

- Acceptable mechanism and recovery periods for correcting situations of over or underfunding should be in place and provide incentives to build reserves against future market downturns.
  - Contributions should cover the normal costs and allow prudent amortization of supplemental costs over time to achieve a smoother contribution schedule and more stable funding levels.
  - Allows flexibility for the temporary limited under-funding and over-funding. Structural underfunding should be prohibited.
- (iii) Wind-up or termination of pension plans.
- Core Principle 7 defines wind-up as a plan that is terminated or when the plan's obligation to pay benefits to members and beneficiaries is extinguished.
    - The allocation of the plan assets and the responsibility for underfunding should be clearly established in the event of windup.
    - When assets exceed liabilities, there should be rules to determine the allocation of the funding surplus; when assets are insufficient to cover benefit obligation, there should be rules to determine the allocation of the benefit payment.
    - Creditor rights of pension plan members and beneficiaries should be recognized in the case of bankruptcy of the plan sponsor or pension fund.
    - Legal provisions should be put in place to ensure that employee contributions owed to the plan are paid in the event of insolvency or at least has priority rights relative to other creditors.
    - Vested entitlement should be protected from creditors by the legal separation of plan assets.
  - PBA defines wind-up as the termination of a pension plan and the distribution of plan assets.
    - On a wind-up, benefits of all employees become immediately vested and the portability rights available in the case of the termination of employment of an individual who is not entitled to an immediate pension may be exercised by any employee who is entitled to a benefit.
    - If the valuation shows that the assets of the plan are more than sufficient to cover liabilities (including employees' wind-up rights), the resulting surplus in the plan will be distributed. If the plan does not address how surplus is to be distributed on wind-up, it must be distributed proportionately.
    - If the valuation shows that the plan is in a deficit position, the employer is obliged to pay into the plan the amount necessary to ensure that the pension entitlements under the plan will be paid. In the case where an employer is insolvent and not able to make the payment required, subject to the payment from the Pension Benefits Guarantee Fund, the PBA requires that the plan benefits be reduced in proportion to the wind-up deficiency.

## 7. Continued

- The Pension Benefits Guarantee Fund provides protection of the pension benefits of Ontario employees who are members of defined benefit pension plans registered under the PBA, subject to certain exceptions and limits.
- If a pension plan provides enhanced early retirement benefits, the PBA allows older or long-service members who meet “rule of 55” to “grow in” to the enhanced early retirement benefits they would have received if their plan had not been wound up.

## 8. Learning Objectives:

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

### Learning Outcomes:

- (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.

### Sources:

Provisions for Adverse Deviations in Going Concern Actuarial Valuations,

A Practical Approach to Establishing Margins for Adverse Deviations in Going Concern Funding Valuations

FR-144-20: FSRA - Frequently Asked Questions Pertaining to the 2018 Funding Reform for Defined Benefit Pension Plans

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) Describe the considerations for setting the best estimate going concern discount rate.

### Commentary on Question:

*Generally, most candidates were able to provide information on the most common approaches used to determine a best estimate going concern discount rate.*

There are two typical approaches to setting a best estimate going concern discount rate:

1. Building block approach
  - a. Determine the best estimate of long-term, expected future investment returns for various asset classes
  - b. Combining best estimate long-term, expected future investment returns for different asset classes to reflect a plan's investment policy
  - c. With consideration for effects of diversification and rebalancing
  - d. Considering inclusion of an allowance for additional return due to active vs passive management
  - e. Making appropriate provision for expenses



## 8. Continued

2. Based on fixed income yields
  - a. Where an immunized portfolio is established to match projected cash flows, appropriate to base the discount rate assumption on the yield of the immunized portfolio
  - b. The asset mix has no impact on the setting of the discount rate in this approach
- (b) Recommend an approach for establishing the margin on the going concern discount rate.

### **Commentary on Question:**

*The candidates who did well on this question clearly stated a recommendation of how to establish a margin, and provided details on its development. Many candidates did not provide either a clear recommendation and/or enough information on how it would be developed.*

There are a number of approaches on how to establish a margin on the going concern discount rate. Three potential approaches are outlined below but there may be other ways that could be considered a reasonable answer if enough detail is provided.

#### Sample Approach 1

- Recommendation: Incorporate PfAD in accordance with ON pension legislation (or similar)
- Determine whether closed or open plan and apply associated amount (with ON pension legislation or other reasonable amount provided)
- Determine proportion of fixed income and non-fixed income assets based on investment policy and regulations, apply associated amount (with ON pension legislation or other reasonable amount provided)
- If discount rate exceeds benchmark, apply associated amount (with ON pension legislation benchmark or other reasonable amount provided)

#### Sample Approach 2

- Recommendation: Using a building block approach incorporating margins within the components of a going concern discount rate
- Determine a risk-free rate using historical 10 year GoC bond yields
- Equity risk premium, start with best estimate and adjust downwards based on maturity of plan with larger margin for mature plans
- Incorporate margin for fixed-income risk premium
- Diversification & rebalancing: best estimate of 0.5% and reduced for margin
- Assume no added return from active management

## 8. Continued

### Sample Approach 3

- Recommendation: Incorporate explicit margin based on plan characteristics
- Plan's Investment policy: margin is higher for plans that adopt a riskier investment policy. The higher the proportion of pension fund invested in nonfixed income assets, the higher the discount rate margin required
- Plan maturity: margin higher for mature plans than for less mature plans
- Current level of long-term interest rates: it moves with long-term interest rates that fall within a specified range—a higher (lower) margin is applied when interest rates move up (down)

## 9. Learning Objectives:

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

### Learning Outcomes:

- (5a) The candidate will be able to describe and apply regulation pertaining to plan design.
- (5h) The candidate will be able to describe and apply regulation pertaining to members' rights.

### Sources:

Canada Revenue Agency PA Guide

Canadian Pensions and Retirement Income Planning, Willis Towers Watson, 6th Edition, 2017 - Chpt 22

### Commentary on Question:

*The question was answered well by most of the candidates. However, some students did not apply the correct PA formula when dealing with two benefit periods/employers.*

### Solution:

Calculate the total 2021 Pension Adjustment for each member from all employers.

Show all work.

### Member A

2021 PA formula = (9 x 2021 DB accrual) – 600

#### PA calculation for January 1st to June 30th

Service = 0.5 year.

$$\begin{aligned} \text{Pension Plan Accrual} &= [1.0\% \times \$61,600 + 1.5\% (\$250,000 - \$61,600)] \times 0.5 \\ &= [\$616 + \$2,826] \times 0.5 = \$1,721 \end{aligned}$$

$$\text{ITA Maximum Accrual} = \$3,245.56 \times 0.5 = \$1,622.78$$

$$\text{PA (January 1 to June 30)} = 9 \times \min(\$1,721, \$1,622.78) - 600 = \mathbf{\$14,005}$$

#### PA calculation for September 30th to December 31st

Service = 0.25 year.

$$\begin{aligned} \text{2021 Pension Plan Accrual} &= [1.0\% \times \$61,600 + 1.5\% (\$250,000 - \$61,600)] \times 0.25 \\ &= [\$616 + \$2,826] \times 0.25 = \$860.50 \end{aligned}$$

$$\text{ITA Maximum Accrual} = \$3,245.56 \times 0.25 = \$811.39$$

$$\text{PA (September 30th to December 31st)} = 9 \times \min(\$860.50, \$811.39) - 600 = \mathbf{\$6,703}$$

$$\mathbf{\text{Total 2021 PA} = \$14,005 + \$6,703 = \$20,708}$$

## 9. Continued

### Member B

2021 PA formula = (9 x 2021 DB accrual) – 600

2021 service = 1 year. Since member accrued service while disabled, a full year service used for PA.

Since member's service was restated before April 30, 2022, a corrected PA will be filed (not a PSPA)

2021 Pension Plan Accrual = [1.0% x \$61,600 + 1.5% (\$110,000-\$61,600)] x 1  
= \$616 + \$726 = \$1,342

ITA Maximum Accrual = \$3,245.56

2021 PA = 9 x min (\$1,342, \$3,245.56) – 600 = \$11,478

### Member C

2021 PA formula = (9 x 2021 DB accrual) – 600

#### **PA under first employer**

Service: 7/12 = 0.5833

2021 Pension Plan Accrual = [1.0% x \$61,600 + 1.5% (\$130,000- \$61,600)] x 0.5833  
= [\$616 + \$1,026] x 0.5833  
= \$957.78

ITA Maximum Accrual = \$3,245.56 x 0.5833 = \$1,893.14

2021 PA = 9 x min (\$957.78, \$1,893.14) – 600 = \$8,020

#### **PA under second employer**

Service: 5/12 = 0.4167

2021 Pension Plan Accrual = [1.0% x \$61,600 + 1.5% (\$140,000-\$61,600)] x 0.4167  
= [\$616 + \$1,176] x 0.4167  
= \$746.73

ITA Maximum Accrual = \$3,245.56 x 0.4167 = \$1,352.42

2021 PA = 9 x min (\$746.73, \$1,352.42) – 600 = \$6,121

**Total 2021 PA = \$8,020+ \$6,121 = \$14,141**

## 9. Continued

### Member D

$$2021 \text{ PA formula} = (9 \times 2021 \text{ DB accrual}) - 600$$

$$2021 \text{ service} = 2/12 = 0.1667$$

$$\begin{aligned} 2021 \text{ Pension Plan Accrual} &= [1.0\% \times 30,000] \times 0.1667 \\ &= [300] \times 0.1667 \\ &= 50 \end{aligned}$$

$$\text{ITA Maximum Accrual} = \$3,245.56 \times 0.1667 = 541.03$$

$$2021 \text{ PA} = 9 \times \min(\$50, \$541.03) - 600 = -\$150$$

Since calculated PA is negative, **2021 PA = \$0**