

Exam RETFRC

Funding & Regulation Exam - Canada

Date: Thursday, April 28, 2022

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 10 questions numbered 1 through 10 with a total of 100 points.

The points for each question are indicated at the beginning of the question.

2. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions provided in this document.

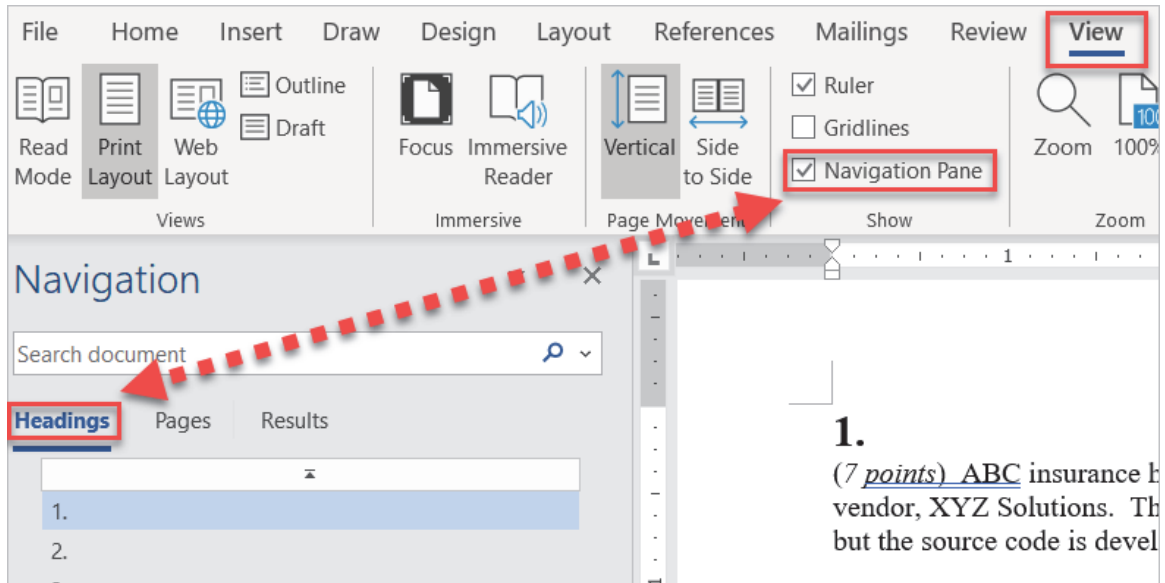
Written-Answer Instructions

1. Each question part or subpart should be answered either in the Word document or the Excel file as directed. Graders will only look at work in the indicated file.
 - a) In the Word document, answers should be entered in the box marked ANSWER. The box will expand as lines of text are added. There is no need to use special characters or subscripts (though they may be used). For example, β_1 can be typed as beta_1 (and ^ used to indicate a superscript).
 - b) In the Excel document formulas should be entered. Performing calculations on scratch paper or with a calculator and then entering the answer in the cell will not earn full credit. Formatting of cells or rounding is not required for credit.
2. The answer should be confined to the question as set.
3. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.
4. The Word and Excel files that contain your answers must be uploaded before the five-minute upload period expires.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:



1.

(3 points) Company ABC sponsors a single-employer defined benefit pension plan.

You are given:

Plan Provisions:

Normal retirement benefits: 1.5% of earnings for each year of service
Normal retirement age: Age 65
Eligibility: Member may join on date of hire

Member data as at January 1, 2022:

Date of hire:	January 1, 2020
Date of membership:	January 1, 2021
Credited service:	1 year
2020 earnings	\$75,000
2021 earnings	\$77,000
Qualifying transfers	\$0
Excess money purchase transfers	\$0

The member has requested a buy back of service from date of hire.

(a) (1 point) Calculate the Past Service Pension Adjustment (PSPA).

ANSWER:

You have submitted the PSPA application on behalf of the member. You received a letter from the Canada Revenue Agency indicating that the PSPA cannot be certified. The letter provides the following information:

Member's unused RRSP deduction room at the end of 2021	\$500
Member's qualifying withdrawals	\$0
Member's Pension Adjustment Reversal (PAR) for 2022	\$0

(b) (2 points) Describe in words the options that are available to the member to have the PSPA certified.

ANSWER:

2.

(3 points) Company XYZ sponsors a single-employer pension plan that consists of both a defined benefit provision and a defined contribution provision. The plan provides the following benefits:

Defined Benefit Provision	Annual pension of 1.2% of pensionable earnings per year of credited service.
Defined Contribution Provision	Required employer contribution of 1% of pensionable earnings. Plus Required employee contribution of 2% of pensionable earnings.

You are given:

Member data:

	Member A
2022 Pensionable earnings	\$200,000
2022 T4 earnings	\$250,000
2022 Defined benefit limit	\$3,420
2022 Money purchase limit	\$30,780
Available RRSP contribution room in 2022	\$3,500

Company XYZ is considering increasing the employer DC contributions.

- (a) (2 points) Calculate the maximum contribution, in dollars, to the defined contribution provision that Company XYZ may make for Member A in 2022.

ANSWER:

- (b) (1 point) Company XYZ decides not to change the defined contribution provision. Calculate the maximum total contribution (employee and employer) to the DC plan plus to Member A's personal Registered Retirement Savings Plan (RRSP) for 2022.

ANSWER:

3.

(8 points) Your client sponsors a contributory defined benefit pension plan.

You are given:

Plan Provisions:

Normal retirement benefit:	2% of final average earnings (base salary + bonus) times credited service
Early retirement benefit:	4% reduction for each year prior to age 65
Termination benefit:	Deferred pension payable at age 65 or lump sum commuted value transfer

Your colleague completed the January 1, 2020 funding valuation that was filed with the regulator. The data used in the valuation is given below:

Participant Data as of January 1, 2020:

ID	Status	Date of Birth (mm/dd/yyyy)	Gender	Earnings	Years of Credited Service
7005	Active	6/21/1923	F	\$60,000	10
7771	Active	3/8/1995	M	\$80,000	2
8225	Active	11/17/1982	M	\$100,000	5
9156	Active	1/20/1960	F	\$125,000	25
9877	Active	8/8/1950	F	\$55,000	42

ID	Status	Date of Birth (mm/dd/yyyy)	Gender	Form of pension	Spouse gender	Spouse DOB (mm/dd/yyyy)	Pension Amount or Deferred Vested Pension
2001	Deferred Vested	9/7/1956	M		F	2/4/1957	\$2,000
3101	Pensioner	10/12/2020	M	JS 60%	F	4/12/1952	\$1,000
4400	Pensioner	2/19/1953	F	Life Only	M	8/5/1949	\$5,000
5005	Pensioner	12/26/1940	M	JS 60%	M	12/26/1940	\$10,000
6600	Beneficiary	6/1/1945	F	JS 100%	M	8/20/1944	\$2,000

3. Continued

New data provided for the January 1, 2021 is as follows:

Participant Data at January 1, 2021:

ID	Status	Date of Birth (mm/dd/yyyy)	Gender	Earnings	Years of Credited Service
7005	Active	6/21/1971	F	\$30,000	11
7771	Active	3/8/1995	M	\$81,600	3
8625	Active	7/28/1986	M	\$105,000	2
9877	Active	8/8/1950	F	\$56,100	26

ID	Status	Date of Birth (mm/dd/yyyy)	Gender	Form of pension	Spouse gender	Spouse DOB (mm/dd/yyyy)	Pension Amount or Deferred Vested Pension
2001	Deferred Vested	9/7/1956	M		F	2/4/1957	\$2,000
3101	Pensioner	10/12/1949	M	JS 60%	F	4/12/1952	\$1,000
4400	Pensioner	2/19/1953	F	Life Only	M	8/5/1939	\$5,000
5005	Beneficiary	12/26/1940	M	JS 60%	M	12/26/1940	\$10,000
6600	Beneficiary	6/1/1945	F	JS 100%	M	8/20/1944	\$2,000
9156	Pensioner	1/20/1960	F	JS 100%	M	11/7/1956	\$425

- (a) (4 points) Identify potentially incorrect, missing, or incomplete data required for each valuation.

ANSWER:

- (b) (2 points) Describe the process you would follow to address the errors in the January 1, 2020 valuation, taking into account professional standards.

ANSWER:

- (c) (2 points) List the required disclosures regarding the data in accordance with the Standards of Practice.

ANSWER:

4.

(32 points) Your client sponsors a non-contributory defined benefit pension plan registered in Ontario. As the actuary of the plan, you are responsible for determining the funded status of the plan and the contribution requirements. A full actuarial valuation for funding purposes is required to be performed as at December 31, 2020.

The plan provisions are as follows:

Retirement benefit:	1.75% of Final 3-year Average Earnings
Member Contribution requirements:	None required or permitted
Normal retirement age (NRA):	Age 65
Earliest retirement age:	Age 55
Unreduced early retirement age (UERA):	Age 60, with 20 or more years of service
Early retirement reduction:	<i>With 20 or more years of service: 3% per year prior to age 60</i>
	<i>Otherwise: Actuarial equivalent to NRA</i>
Termination benefits:	Pension deferred to NRA
	Early commencement with actuarial equivalent benefit
Form of payment:	Life only. Optional forms available on an actuarial-equivalent basis
Pre-retirement cost of living adjustment:	None
Post-retirement cost of living adjustment:	Pensions in payment are increased annually at 100% of inflation

4. Continued

The following information is as at December 31, 2020:

Actuarial Assumptions and Methods:

Going concern assumptions:		
Discount rate:	4.90% per year	
Inflation:	2.00% per year	
Salary increases:	3.00% per year	
Explicit expense allowance:	\$45,000	
Pre-retirement mortality:	None	
Actuarial Cost Method:	Projected Unit Credit	
Retirement age (actives):	Age	Rate per year
	UERA	50.0%
	65	100.0%
Retirement age (deferred):	Assume retirement at UERA	
Termination rates:	Age	Rate per year
	under age 50	3.0%
	50 and over	0.0%
Form of benefit elected:	100% of eligible members receive a pension from the plan	
Termination Assumption:	Assume 100% of terminations and retirements are involuntary	
Assets:	Actuarial value of assets - realized and unrealized capital gains (losses) arising during a given year are spread on a straight-line basis over 3 years	

4. Continued

Information for calculation of the provision for adverse deviations (PfAD):

Plan Type (Closed):	5.0%
Non-Fixed Income Percentage is 60% with related PfAD Component:	7.0%
Benchmark discount rate (BDR):	4.9%

Solvency assumptions:

Solvency basis:	Solvency liabilities are set to equal wind-up liabilities
Form of benefit settlement elected by member	
- Active and Deferred Members:	100% elect lump sum
Basis for benefits assumed to be settled through a lump sum	
- Solvency discount rate:	1.40% for 10 years, 2.90% thereafter
- Inflation:	0.60% for 10 years, 1.90% thereafter
Basis for benefits assumed to be settled through the purchase of an annuity	
- Interest rate:	2.5%
- Inflation rate:	3.3%
Termination expenses:	\$150,000
Retirement age:	50% at UERA and 50% at best age

Amortization Schedules from previous valuation:

Type	Monthly amortization payment	Date established	Start date	Date of last payment
Going concern one	4,000	2019-12-31	2020-01-01	2020-12-31
Going concern two	1,500	2019-12-31	2021-01-01	2030-12-31
Solvency one	1,200	2016-12-31	2017-01-01	2021-12-31
Solvency two	1,400	2019-12-31	2021-01-01	2025-12-31

4. Continued

Membership information:

Active Members:	ID1	ID2
Age:	49	54
Earnings for 2018:	55,000	68,000
Earnings for 2019:	58,000	72,000
Earnings for 2020:	61,000	74,000
Years of service:	4.0	12.0
Status:	Full-time	Full-time
Deferred Members:	ID3	ID4
Terminated involuntarily:	Yes	Yes
Age:	39	60
Age at termination:	35	50
Service at termination:	5.0	20.5
Annual deferred pension:	8,600	12,000
Pensioners:	ID5	ID6
Age:	63	68
Spouse's age:	n/a	64
Retirement date:	2014-07-01	2003-01-01
Annual pension:	12,100	9,900
Form of pension:	Life only	J&S60%

Asset Information (in \$):

	2018	2019	2020
January 1 market value of assets:	895,000	1,064,440	1,027,320
Company Current Service Cost, Expense Allowance and PfAD	105,000	107,000	109,000
Company special payments	0	60,000	108,000
Pension paid	-20,740	-21,150	-21,570
Lump sums paid	0	0	0
Administration and investment fees	-65,120	-66,470	-69,430
Investment income	50,000	-16,500	-65,400
Gains (losses) – realized or unrealized	100,300	-100,000	28,900
December 31 market value of assets:	1,064,440	1,027,320	1,116,820

There are no in-transit amounts as at December 31, 2020 or December 31, 2021.

4. Continued

Investment Policy:

Fixed Income Component (L) (Investment Grade)	40%
Alternative Investment Component (M)	0%
Non-Fixed Income Component	60%

Annuity Factors (Life only factors except where noted otherwise):

Going Concern Annuity factors (indexed):

Provided in Excel.

Going Concern Annuity factors (non-indexed):

Provided in Excel

Solvency Annuity factors:

Provided in Excel

(a) (15 points) You are asked to perform the actuarial valuation as at December 31, 2020.

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

The response for this question is to be provided in the Excel spreadsheet.

(ii) Calculate the funded status of the plan on a solvency basis.

The response for this question is to be provided in the Excel spreadsheet.

(iii) Calculate the minimum contribution requirements for 2021 and 2022 based on the December 31, 2020 valuation.

The response for this question is to be provided in the Excel spreadsheet.

4. Continued

- (b) (14 points) The next required valuation date is December 31, 2021. You are asked to complete the actuarial valuation as at December 31, 2021 based on the information provided below:

Member ID	Status at December 31, 2021
ID1	Active
ID2	Active
ID3	Paid Out on March 31, 2021 - \$122,500
ID4	Deferred
ID5	Pensioner
ID6	Pensioner died in August 2021. Spouse received spousal pension effective September 1, 2021

Other Data Experience:

	ID1	ID2
Earnings for 2021:	70,000	76,220

Going Concern Assumptions:

Discount rate:	3.60%	(per year)
Benchmark discount rate (BDR):	4.50%	(per year)

All other assumptions are the same as at December 31, 2020.

Asset information (in \$):

December 31, 2020 market value:	1,116,820
Company Current Service Cost, Expense Allowance and PfAD	85,000
Company special payments	50,000
Pension paid	-20,680
Lump sums paid	-122,500
Administration and investment fees	-45,300
Investment income	1,560
Gains (losses) – realized or unrealized	260,000
December 31, 2021 market value:	1,324,900

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

The response for this question is to be provided in the Excel spreadsheet.

- (ii) Calculate the sources of gain/(loss) of the going concern liabilities from December 31, 2020 to December 31, 2021.

The response for this question is to be provided in the Excel spreadsheet.

4. Continued

- (c) (3 points) Calculate the funded position on a going concern basis including PfAD, under the following two Plausible Adverse Scenarios. Use duration to estimate the change in liabilities.

The going concern liability durations are:	Indexed	Non-indexed
	17.5	16.1

- (i) Interest Rate Shock: 90 bps drop in discount rate and 7% increase in fixed income portion of assets.

The response for this question is to be provided in the Excel spreadsheet.

- (ii) Equity Market Shock: Discount rate shift of 0% and 15% drop in equity market.

The response for this question is to be provided in the Excel spreadsheet.

5.

(7 points)

- (a) (2 points) Describe when it would be appropriate to use an alternative settlement method for a hypothetical wind-up valuation, in accordance with the Revised CIA Educational Note on Alternative Settlement Methods for Hypothetical Wind-Up and Solvency Valuations.

ANSWER:

- (b) (3 points) Describe the considerations for building a replicating portfolio for use with the alternative settlement method.

ANSWER:

- (c) (2 points) Describe the required disclosures in the valuation report when using the alternative settlement method for the purpose of calculating the hypothetical wind-up liabilities.

ANSWER:

6.

(9 points) ABC Company sponsors a defined benefit pension plan registered in Ontario. Currently the plan consists of mostly active members with a small number of retirees. You are setting the going concern discount rate assumption for the actuarial valuation as at January 1, 2022.

The plan's target asset mix as stipulated in its Statement of Investment Policies and Procedures is as follows:

Asset class	Target asset allocation
Cash equivalents	5%
Universe bonds	40%
Canadian equities	30%
Global equities	25%

The portfolio will be rebalanced regularly so that the asset mix will be maintained within a reasonable range of the target asset mix.

The expected return on long-term government of Canada bonds at the valuation date is 2.2%, and the estimated risk premia per year for each asset class (on a geometric basis) over three different time horizons are as follows:

Asset class	5-year risk premium	10-year risk premium	20-year risk premium
Cash equivalents	-0.8%	-0.9%	-1.0%
Universe bonds	0.2%	0.4%	0.3%
Canadian equities	4.3%	4.5%	4.1%
Global equities	7.5%	8.0%	8.5%

6. Continued

You are also given:

- The plan employs an active management strategy for equities.
- The total investment management fees are expected to be 0.60%, out of which 0.25% are for passive investment management only.
- In the past three years, the active investment manager has outperformed benchmark indices by approximately 0.5% (net of the additional investment management fees associated with active management).
- The average rate of non-investment related administrative expenses over the last three years is 0.8%.

Recommend the going concern discount rate, net of all expenses. Justify your recommendation.

ANSWER:

7.

(10 points) The investment consulting practice of your firm is developing a new tool to help pension actuaries determine the expected investment return on pension plan assets for going concern funding valuations, based on current market conditions.

You have been tasked with reviewing the new tool for use by the pension consulting practice.

- (a) (2 points) Explain why your firm's new tool meets the definition of a model, as defined in the Canadian Institute of Actuaries' (CIA) Standards of Practice.

ANSWER:

- (b) (1 point) List three other examples of models that would meet the CIA's definition.

ANSWER:

Your firm's investment consulting practice is staffed by CFA charterholders.

- (c) (2 points) Describe the steps you would take to assess and document the risk of the pension consulting practice using the new tool.

ANSWER:

- (d) (3 points) Recommend the risk rating you would assign to this tool. Justify your recommendation.

ANSWER:

- (e) (2 points) Explain whether or not disclosures related to the use of this new tool will be required for external user reports.

ANSWER:

8.

(9 points) You are given the following information for two members terminating from a single-employer defined benefit pension plan registered in Ontario:

Member data:

	Member A	Member B
Date of birth:	January 1, 1973	January 1, 1988
Date of termination:	January 1, 2023	January 1, 2023
Pensionable service (years):	4	10.5
Eligibility service (years):	5	10.5

You are given:

Year	Member A		Member B		ITA Maximum DB Pension Limit
	Service	Salary	Service	Salary	
2012	0		0.5	\$28,000	\$2,646.67
2013	0		1	\$61,000	\$2,696.67
2014	0		1	\$62,000	\$2,770.00
2015	0		1	\$64,000	\$2,818.89
2016	0		1	\$64,500	\$2,890.00
2017	0		1	\$67,000	\$2,914.44
2018	0	\$147,000	1	\$68,000	\$2,944.44
2019	1	\$158,000	1	\$70,500	\$3,025.56
2020	1	\$161,000	1	\$69,500	\$3,092.22
2021	1	\$167,000	1	\$71,500	\$3,245.56
2022	1	\$172,000	1	\$71,500	\$3,420.00

Plan provisions:

Normal retirement age:	Age 65
Normal retirement benefit:	2.0% per year of service times the average of the best 3 years of salary
Eligibility for early retirement:	Age 55
Early retirement benefit:	Unreduced at age 62; otherwise 3% reduction from age 62
Termination benefit:	Deferred pension starting at the Normal Retirement Age Payable from age 55, reduced by 4% per year from age 65
Portability:	Participants may choose a lump-sum commuted value in lieu of an immediate or deferred pension at all ages
Cost-of-living adjustments:	CPI minus 1%, pre- and post-retirement
ITA Maximum Pension Test:	Calculated at pension commencement date

8. Continued

Additional information:

Month	V122542 (7 year)	V122544 (long)	V122553 (real)
January 2023	0.52%	1.45%	-0.08%
December 2022	0.48%	1.24%	-0.24%
November 2022	0.51%	1.22%	-0.26%

Month	Mid-Term Provincial Bond Index	Long-Term Provincial Bond Index	Mid-Term Corporate Bond Index	Long-Term Corporate Bond Index	Mid-Term Federal Non- Agency Bond Index	Long-Term Federal Non- Agency Bond Index
January 2023	1.149%	2.165%	1.802%	2.994%	0.683%	1.316%
December 2022	1.104%	2.010%	1.843%	2.878%	0.614%	1.124%
November 2022	1.191%	2.051%	1.996%	2.957%	0.608%	1.060%

Annuity factors:

Annuity factors exclude pre-retirement indexation.

5 ä 50 ⁽¹²⁾	23.2	20 ä 35 ⁽¹²⁾	16.4
6 ä 50 ⁽¹²⁾	22.3	21 ä 35 ⁽¹²⁾	15.7
7 ä 50 ⁽¹²⁾	21.5	22 ä 35 ⁽¹²⁾	14.9
8 ä 50 ⁽¹²⁾	20.6	23 ä 35 ⁽¹²⁾	14.2
9 ä 50 ⁽¹²⁾	19.8	24 ä 35 ⁽¹²⁾	13.5
10 ä 50 ⁽¹²⁾	19.0	25 ä 35 ⁽¹²⁾	12.8
11 ä 50 ⁽¹²⁾	18.0	26 ä 35 ⁽¹²⁾	12.2
12 ä 50 ⁽¹²⁾	17.1	27 ä 35 ⁽¹²⁾	11.6
13 ä 50 ⁽¹²⁾	16.2	28 ä 35 ⁽¹²⁾	11.0
14 ä 50 ⁽¹²⁾	15.3	29 ä 35 ⁽¹²⁾	10.4
15 ä 50 ⁽¹²⁾	14.5	30 ä 35 ⁽¹²⁾	9.8

8. Continued

- (a) (3 points) Calculate the commuted value interest rates under Section 3500 of the Canadian Institute of Actuaries' Standards of Practice as at the date of termination.

The response for this part is to be provided in the Excel spreadsheet.

- (b) (4 points) Calculate the commuted value at the members' date of termination assuming the members terminated:
- (i) Voluntarily; and
 - (ii) Involuntarily.

The response for this question is to be provided in the Excel spreadsheet.

- (c) (2 points) The members terminated their employment voluntarily and elected to receive lump-sum commuted values.

Calculate the pension adjustment reversals (PARs) for both members.

The response for this question is to be provided in the Excel spreadsheet.

9.

(11 points) Your client sponsors a non-contributory defined benefit pension plan. You are given:

Plan Provisions:

Normal retirement benefit:	1% of each year's earnings
Normal form of payment:	Life only, payable monthly in advance
Normal retirement age:	Age 62
Termination benefit:	Monthly pension deferred to normal retirement age

Actuarial Assumptions and Methods:

Discount rate:	5% per year
Salary increase rate:	4% per year
Retirement rates:	Age 60 - 25% Age 61 - 33.33% Age 62 - 100%
Pre-retirement decrements:	None
Actuarial cost method:	Individual Level Premium

Participant Data at January 1, 2021:

	Member A	Member B	Member C
Age:	40	50	60
Service:	15 years	20 years	25 years
2021 Salary:	\$70,000	\$90,000	\$100,000

	Member A	Member B	Member C
Actuarial Liability at January 1, 2020	\$150,000	\$240,000	\$330,000
Normal Cost at January 1, 2020	\$7,000	\$10,000	\$8,000

Annuity Factors:

$\ddot{a}_{60}^{(12)} =$	14.8	$\ddot{a}_{61}^{(12)} =$	14.5	$\ddot{a}_{62}^{(12)} =$	14.3
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Additional Information:

Market value of assets at January 1, 2021:	\$750,000
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- (a) (5 points) Calculate the unfunded actuarial liability and total normal cost as at January 1, 2021.

The response for this question is to be provided in the Excel spreadsheet.

9. Continued

You are given:

- The fund earns a rate of return of 10% during 2021.
- At December 31, 2021, Member A receives a 10% salary increase, and Members B and C receive 4% salary increases.
- A contribution of \$50,000 is made to the plan on December 31, 2021.

- (b) (4 points) Calculate the unfunded actuarial liability and total normal cost as at January 1, 2022.

The response for this question is to be provided in the Excel spreadsheet.

- (c) (2 points) Calculate the impact of demographic experience, by source, between January 1, 2021 and January 1, 2022, on the normal cost.

The response for this question is to be provided in the Excel spreadsheet.

10.

(8 points) You are the actuary for Company XYZ that sponsors a closed defined benefit pension plan. You are undertaking a funding valuation as at December 31, 2021 and are setting assumptions that will be used for the hypothetical wind-up valuation.

You are given:

- Company XYZ is considering a de-risking strategy that will utilize a buy-in group annuity contract and received an annuity quote as at September 30, 2021.
- There are 5,000 retirees and beneficiaries currently in payment. All of the retiree and beneficiary pensions were included in the annuity quote.
- The annuity quote was lower than expected based on the Canadian Institute of Actuaries' guidance on setting annuity purchase rates at the time of the quotation.
- There have been no significant events or changes to membership between the date of the annuity quote and the valuation date.

- (a) (4 points) Describe the considerations for setting the assumptions that will be used to measure the hypothetical wind-up liabilities given the annuity quotation received.

ANSWER:

You are preparing the December 31, 2022 valuation. Company XYZ has suggested that you use the annuity quote received on September 30, 2021 to set the assumptions for the hypothetical wind-up valuation as at December 31, 2022 because it would lower the liability.

- (b) (1 point) Describe the considerations for using the annuity quote from September 30, 2021 for setting the assumptions for the hypothetical wind-up valuation.

ANSWER:

10. Continued

- (c) (3 points) Recommend a course of action for setting assumptions that better reflect the reduction in the liability suggested by the annuity quotation.

ANSWER:

****END OF EXAMINATION****