

# Exam RETRPIRM

**Date:** Thursday, May 6, 2021

## INSTRUCTIONS TO CANDIDATES

### General Instructions

1. This examination has 6 questions numbered 1 through 6 with a total of 40 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,  $\beta_1$  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 time expires.

*Recognized by the Canadian Institute of Actuaries.*

## Navigation Instructions

Open the Navigation Pane to jump to questions.

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



**1.**

(6 points) You are the actuary for ABC Company's defined benefit pension plan that is not fully funded. ABC Company is considering an investment strategy for its pension plan of a 100% government bond portfolio, the cash flows from which closely match the liability cash flows.

- (a) (2 points) Critique the following statement made by the CFO of ABC Company: "The only true representation of the liability of a pension plan is calculated by discounting its cash flows using the risk-free interest rate."

ANSWER:

- (b) (4 points) Describe the advantages and disadvantages of this investment strategy.

ANSWER:

## 2.

(7 points) Company XYZ sponsors a defined benefit pension plan.

You are given:

Discount Rate	4.00%
Liability	\$850,000,000
Market value of assets	\$750,000,000
Asset allocation - equity	60%
Asset allocation - bonds	40%
Duration of bond portfolio (years)	5.0

You are also given the following sensitivities:

Discount rate	Liability
3.00%	\$925,000,000
5.00%	\$775,000,000

- (a) (1 point) Calculate the interest-rate hedge ratio of the current asset mix.

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

The following interest-rate swap is available:

	Duration (years)
Receive-fixed interest rate swap	15

- (b) (3 points) For a 50 basis-point drop in interest rates, Company XYZ would like to limit its deficit to \$120 million. Calculate the minimum face value of the available interest-rate swap that would achieve Company XYZ's goal.

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

Company XYZ will invest in an asset mix with a duration that matches the liabilities.

- (c) (3 points) Critique the strategy of constructing an asset portfolio where assets and liabilities are matched only based on total duration for the purpose of managing interest rate risk.

ANSWER:

### 3.

(5 points)

- (a) (2 points) Describe the considerations for adhering to prudent investment principles for co-trustees.

ANSWER:

Given the volatility in the markets, the trustees of a defined benefit pension plan have elected to invest only in corporate bonds issued by retail companies.

- (b) (3 points) Explain how the strategy may or may not be violating prudent investment practices.

ANSWER:

#### 4.

(8 points) You are given the following for an investment portfolio:

Asset Class	Allocation	Arithmetic Average Return	Standard Deviation of Annual Returns
Global Equity	40%	9.3%	17.2%
Bonds	60%	3.5%	6.0%

Correlation between Global Equity and Bonds	0.2
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- (a) (2 points) Calculate the standard approximation of the expected geometric average return of the portfolio above.

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

- (b) (3 points) Describe the process and considerations for constructing an efficient frontier for optimizing the asset return and risk of an investment portfolio.

ANSWER:

You are advising your client, Company XYZ, on the strategic asset mix for their defined benefit pension plan. Company XYZ's goal is to minimize the downside risk that their pension plan poses to their balance sheet, while targeting an improvement in their funded ratio.

- (c) (3 points) Recommend variations to the efficient frontier that you would derive for the purpose of advising Company XYZ on their investment strategy, in light of the goal stated above.

ANSWER:

## 5.

(8 points)

- (a) (2 points) Describe the key objectives of performance measurement tools.

ANSWER:

- (b) (2 points) Describe the strengths and weaknesses of the following performance measurement tools:

- (i) Attribution Analysis
- (ii) Information Ratio

ANSWER:

- (c) (4 points) You are performing a macro attribution analysis for a fund for a one-month period.

You are given:

Asset Class	Policy weight	Index return	Manager Benchmark Return	Manager Actual Return
Bonds	30%	3.52%	3.52%	4.02%
Equities	50%	-4.03%	-1.26%	-1.35%
Real Estate	20%	1.04%	2.03%	4.01%

Fund value - beginning of month	\$132,685,956
Fund value - end of month	\$133,269,850
Contributions during month	\$2,530,120
Benefit payments during month	\$4,213,535
Return on 90-Day Treasury bills	0.52%

Calculate the incremental return contribution and incremental value contribution of the six levels of investment policy decision-making for the fund by filling out the table in Excel.

**5. Continued**

Decision-Making Level (Investment Alternative)	Fund Value	Incremental Return Contribution	Incremental Value Contribution
Beginning value	\$132,685,956		
Total Fund	\$133,269,850		

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



**6.**

(6 points)

- (a) (3 points) Describe the objectives of the following stakeholders with respect to a public defined benefit pension plan:
- (i) Taxpayers;
  - (ii) Elected officials; and
  - (iii) Plan participants.

ANSWER:

The pension department of a government that sponsors a defined benefit pension plan has decided to implement an asset liability management framework.

- (b) (3 points) Explain how an asset liability management framework would affect the stakeholders from part (a) in terms of their objectives.

ANSWER:

**\*\*END OF EXAMINATION\*\***