
SOCIETY OF ACTUARIES
Retirement Plan Investment & Risk Management Exam

Exam RETRPIRM

Date: Friday, April 27, 2018

Time: 2:00 p.m. – 4:15 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 40 points.

This exam consists of 6 questions, numbered 1 through 6.

The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. 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 on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate Exam RETRPIRM.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

****BEGINNING OF EXAMINATION****

1. (6 points)

- (a) (3 points) Describe the advantages and risks of investing pension plan assets in infrastructure.
- (b) (3 points) Compare investing pension plan assets in infrastructure to investing in:
 - (i) Fixed income
 - (ii) Real estate
 - (iii) Private equity

- 2.** (5 points) Describe five prudent investment principles under CAPSA Guideline No. 6 – Pension Plan Prudent Investment Practices Guideline.

3. (10 points) XYZ Company sponsors a defined benefit pension plan and is reviewing its liability-driven investment strategy.

You are given:

	Value	Effective Duration	Key Rate Durations		
			Short-term D ₁	Medium-term D ₂	Long-term D ₃
Total plan liabilities	\$50,000,000	14	5	5	4

Current Portfolio	Market Value	Effective Duration	Key Rate Durations		
			Short-term D ₁	Medium-term D ₂	Long-term D ₃
Short-term bond fund	\$35,000,000	5	5	0	0
Medium-term bond fund	\$5,000,000	14	2	10	2
Long-term bond fund	\$5,000,000	28	0	0	28
Equities	\$5,000,000	0	0	0	0

- (a) (1 point) Describe the advantages of key rate duration as a measure of interest rate risk.
- (b) (2 points) Calculate the total effective duration and key rate durations of the asset portfolio.

Show all work.

- (c) (1 point) Calculate the dollar durations of the assets and liabilities.

Show all work.

3. Continued

XYZ Company is considering changing the asset mix to the following portfolio:

Proposed Portfolio	Market Value	Effective Duration	Key Rate Durations		
			Short-term D ₁	Medium-term D ₂	Long-term D ₃
Short-term bond fund	\$3,000,000	5	5	0	0
Medium-term bond fund	\$40,000,000	14	2	10	2
Long-term bond fund	\$2,000,000	28	0	0	28
Equities	\$5,000,000	0	0	0	0

- (d) (2 points) Calculate the dollar change in liabilities and bonds for a parallel shift down in the yield curve of 50 basis points for both portfolios.

Show all work.

- (e) (2 points) Calculate the dollar change in liabilities and bonds given that the long-term rates decrease by 50 basis points but all other rates remain constant for both portfolios.

Show all work.

XYZ Company wants to minimize interest rate risk.

- (f) (2 points) Recommend either the Current Portfolio or the Proposed Portfolio in light of this objective.

Justify your recommendation.

- 4.** (7 points) Shareholders in XYZ Company rebalance their individual portfolios to maintain a 50/50 bond/equity allocation, reflecting both their direct holdings and their indirect holdings through XYZ Company's pension plan.

XYZ Company's pension plan is invested entirely in equities.

- (a) (2 points) Explain how the shareholder value perspective applies to pension plans.

XYZ Company changes its asset portfolio to 100% bonds.

- (b) (2 points) Describe the impact of this change on the following:
- (i) Shareholders' portfolios
 - (ii) Shareholders' after-tax income
- (c) (3 points) Critique the following statement: "Financial economics implies pension plans should invest 100% in bonds."

5. (6 points) XYZ Company sponsors a defined benefit pension plan that is closed to new members.

You are given:

Current asset allocation

	Value	Duration
Fixed Income	\$30,000,000	9.0
Equities	\$40,000,000	0.0

Liabilities (annuity purchase basis)

	Value	Duration
Actives	\$30,000,000	20.0
Deferred members	\$10,000,000	18.0
Retirees	\$60,000,000	12.0

XYZ Company's CFO has the following objectives:

- Reduce the volatility of the plan's funded status
- Terminate the plan once it is fully funded

To achieve these objectives, XYZ Company is considering the following two options:

Option 1

Implementing the following liability-responsive asset allocation strategy (glide path):

Accounting Funded Status	Fixed Income Allocation	Equity Allocation
Under 80%	40%	60%
80% to 90%	55%	45%
90% to 100%	70%	30%
Over 100%	85%	15%

Option 2

Purchasing an annuity buy-in for \$60 million covering pension payments to all retirees. Assume the buy-in is funded with \$30 million of fixed income assets and \$30 million of equities.

- (4 points) Critique each option with respect to the CFO's objectives.
- (2 points) Recommend an alternative strategy to better address the CFO's objectives. Justify your recommendation.

6. (6 points) ABC Company is embarking on an Asset Liability Management (ALM) study to determine the future target asset allocation of its pension plan.

(a) (2 points) Describe the inputs for an ALM study.

(b) (2 points) Describe the outputs of an ALM study.

As part of the ALM study, ABC Company is determining the future fixed income allocation for its pension plan.

You are given:

	Duration	Standard Deviation	Correlations	
			Bond Portfolio A	Bond Portfolio B
Bond Portfolio A	18.2	0.13	1.00	0.75
Bond Portfolio B	6.4	0.65	0.75	1.00
Liabilities	16.1			

(c) (2 points) Calculate the standard deviation of the bond portfolio that matches the duration of the liabilities.

****END OF EXAMINATION****

USE THIS PAGE FOR YOUR SCRATCH WORK

USE THIS PAGE FOR YOUR SCRATCH WORK