CFA Institute
Chartered Financial Analyst® Examination

2017 Level III Morning Session
Essay Questions

The Morning Session of the 2017 Level III CFA® Examination has 10 questions. For grading purposes, the maximum point value for each question is equal to the number of minutes allocated to that question.

Question	Topic	Minutes
1	Portfolio Management – Alternative Investments	19
2	Portfolio Management – Institutional	22
3	Portfolio Management – Performance Evaluation	15
4	Portfolio Management – Individual	15
5	Portfolio Management – Individual/Behavioral	15
6	Portfolio Management – Individual	22
7	Portfolio Management – Economics	14
8	Portfolio Management – Asset Allocation	20
9	Portfolio Management – Fixed Income	21
10	Portfolio Management – Risk Management	17
	Total:	**180**

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QUESTION 1 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 19 MINUTES.

Matterhorn Investments is an alternative investments firm. Urs Brunner, an analyst, is reviewing the performance of Matterhorn's commodities fund. Brunner is analyzing the return components of the fund's investment in the commodity futures contracts shown in Exhibit 1.

Exhibit 1
Futures Contract Details
(in USD)

Contract Maturity	Futures Price at End of February	Futures Price at End of January
August	533.50	518.50
September	528.25	514.75

Brunner notes that from the end of January to the end of February, the spot price of the underlying commodity increased by USD 6.25 and the total return on the August futures contract was a profit of USD 18.00.

A. **Calculate**, for the August contract, the:

i. collateral return (in USD) in February.
ii. roll return (in USD) in February.

Show your calculations.

4 minutes (Answer 1-A on page 5)

Brunner observes that the current shape of the futures curve of a different commodity, nickel, is flat. He wants to analyze how the nickel futures curve would change in a scenario where both the cost of storage and the convenience yield simultaneously decrease by different amounts.

B. **Determine** the *most likely* shape of the nickel futures curve (contango, flat, backwardation, or cannot be determined), given Brunner's proposed scenario. **Justify** your response.

Note: Interest rates and the spot price remain unchanged.

3 minutes (Answer 1-B on page 6)

Matterhorn's management is considering changes to one of its hedge funds. Brunner reviews the likely effect of each change on the fund's reported Sharpe ratio. The potential changes are:

Change 1: Increase the fund's holdings in commodities that trade infrequently.
Change 2: When calculating the fund's annualized rate of return and standard deviation, switch from monthly to daily observations.

C. **Determine** the *most likely* effect (decrease, no change, increase) of *each* change on the fund's reported Sharpe ratio. **Justify** *each* response.

Note: Consider each change independently.

6 minutes (Answer 1-C on page 7)

Matterhorn manages a different hedge fund that uses a hedged equity strategy. Its benchmark for this fund is an investable, manager-based index with a monthly return series. Matterhorn is compensated based on its fund's performance compared to this index, which has the following additional characteristics:

- Index consists of 50 active, hedged equity managers who elect to report monthly returns and holdings.
- Index's historical return series includes past performance of managers who stop reporting returns.
- Index weights are based on each hedged equity manager's assets under management and are rebalanced annually.
- When a manager is added to the index, the index provider does not include that manager's past performance.

D. **Discuss** *two* weaknesses of using this benchmark to measure the performance of Matterhorn's hedge fund.

6 minutes (Answer 1-D on page 8)

Answer Question 1-A on This Page

Calculate, for the August contract, the: (see i. and ii. below)
Show your calculations.

i. collateral return (in USD) in February.

ii. roll return (in USD) in February.

Answer Question 1-B on This Page

Determine the *most likely* shape of the nickel futures curve, given Brunner's proposed scenario.
(circle one)

contango flat backwardation cannot be determined

Justify your response.

(Note: Interest rates and the spot price remain unchanged.)

Answer Question 1-C on This Page

Change	**Determine** the *most likely* effect of *each* change on the fund's reported Sharpe ratio. (circle one)	**Justify** *each* response. (Note: Consider each change independently.)
Change 1	decrease no change increase	
Change 2	decrease no change increase	

Answer Question 1-D on This Page

Discuss *two* weaknesses of using this benchmark to measure the performance of Matterhorn's hedge fund.

1.

2.

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QUESTION 2 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 22 MINUTES.

Marvel Stores is a retailer, based in the country of Vibrania, that offers its employees a defined-benefit pension plan. The mandatory retirement age is 65, but employees may elect to retire early and begin receiving benefits at age 57.

Marvel is required to fund the plan's accrued benefits, which include estimated future wage increases. In addition, Marvel has an objective for each annual plan contribution to be lower than that year's increase in accrued benefits. The company expects that returns on the plan portfolio will make up the difference over time.

In Vibrania, the ratio of active lives to retired lives for the average company's pension plan is 60% / 40%. The expected long-term inflation rate is 2% per year. Marvel has a debt-to-equity ratio of 30% compared to 45% for its peer group. Further information pertaining to the Marvel pension plan is shown in Exhibit 1. Vibrania's currency is the Vibrania Currency Unit (VCU).

Exhibit 1
Marvel Pension Plan Information
31 December 2016

Accumulated benefit obligation (ABO)	VCU 650 million
Projected benefit obligation (PBO)	VCU 900 million
Plan assets	VCU 800 million
Discount rate for plan liabilities	6%
Ratio of active lives to retired lives	75% / 25%

A. **Discuss**, for *each* of the following, *two* factors that indicate the Marvel plan has a:

i. low ability to take risk.
ii. high ability to take risk.

Note: Restating case facts without additional support will not receive credit.

8 minutes (Answer 2-A on page 12)

The Marvel plan's investment committee asks the plan's actuary to analyze the following possible scenarios:

Scenario 1: Decrease the discount rate for plan liabilities by 100 basis points.
Scenario 2: Increase the discount rate for plan liabilities by 100 basis points.
Scenario 3: Stop hiring new employees for an indefinite period of time.
Scenario 4: Increase the minimum age to 60 for the early retirement election.

The investment committee is concerned about the effect of these possible scenarios on the plan's time horizon.

B. **Determine** which scenario would *most likely* shorten the Marvel plan's time horizon. **Justify** your response.

4 minutes (Answer 2-B on page 13)

Two months later, Marvel acquires Grant Stores, which is also based in Vibrania. Grant also offers a defined-benefit pension plan but has significantly fewer employees than Marvel. Marvel decides to keep the two plans separate.

The investment committee is concerned about uncertainty in benefit payments attributable to non-market-related exposures for the Marvel and Grant plans. The plans' actuary notes that one factor creating this "liability noise" is uncertainty related to underlying actuarial probabilities. Although these probabilities are the same for both plans, the actuary states that one of the plans will still have more liability noise than the other.

The Grant plan is invested conservatively and holds only nominal bonds and a small amount of cash. Benefit payments to retired employees are not indexed to inflation. The Grant plan pays retirement benefits based on the average of each eligible employee's last five years of wages. Grant is required to fund the plan's accrued benefits, which include estimated future wage increases that are based both on inflation and real growth.

The Grant plan is fully funded due to generous plan contributions. Marvel's investment committee proposes to shift the Grant plan to a liability mimicking portfolio to ensure that the plan remains fully funded in the future.

C. **Determine** which plan (Marvel or Grant) *most likely* has proportionally more liability noise. **Justify** your response.

4 minutes (Answer 2-C on page 14)

D. **Determine** *two* additional asset classes that should be added to the Grant plan's portfolio to *best* implement the proposal. **Describe** the specific market-related exposure of the pension liability that would be hedged by *each* additional asset class.

6 minutes (Answer 2-D on page 15)

Answer Question 2-A on This Page

	Discuss, for *each* of the following, *two* factors that indicate the Marvel plan has a: (Note: Restating case facts without additional support will not receive credit.)
i. low ability to take risk.	1.
	2.
ii. high ability to take risk.	1.
	2.

Answer Question 2-B on This Page

Determine which scenario would *most likely* shorten the Marvel plan's time horizon.
(circle one)

1 2 3 4

Justify your response.

Answer Question 2-C on This Page

Determine which plan *most likely* has proportionally more liability noise.
(circle one)

Marvel Grant

Justify your response.

Answer Question 2-D on This Page

Determine *two* additional asset classes that should be added to the Grant plan's portfolio to *best* implement the proposal.	**Describe** the specific market-related exposure of the pension liability that would be hedged by *each* additional asset class.
1.	
2.	

QUESTION 3 HAS THREE PARTS (A, B, C) FOR A TOTAL OF 15 MINUTES.

Frederic Collignon is a wealthy individual who asks Tony Spredeman, an independent advisor, to review the performance of his investment account over the past four years. The account is managed by an external advisor, but Collignon has full control over the timing and size of the cash flows being invested into and withdrawn from the account.

Spredeman calculates both the time-weighted return (TWR) and money-weighted return (MWR) for the account. Account values and year-end cash flows are reported in Exhibit 1.

Exhibit 1
Collignon Account Values and Cash Flows
(in USD millions)

Year	Year-end Cash Flow	Year-end Value (including year-end cash flow)
2012	---	90
2013	5	100
2014	5	110
2015	120	230
2016	–30	250

A. **Determine** which annualized return measure (TWR or MWR) is higher for the period 2013–2016. **Explain** the cause of the difference between the account's TWR and MWR.

Note: Calculations of TWR and MWR are not required.

3 minutes (Answer 3-A on page 18)

B. **Determine** which return measure (TWR or MWR) is *more* appropriate to use in evaluating the external advisor's investment performance. **Justify** your response.

3 minutes (Answer 3-B on page 19)

Spredeman compares the performance of two equity managers who are candidates to replace Collignon's external advisor. He gathers data to evaluate each manager's historical performance based on the following criteria:

Criterion 1: Reward per unit of systematic risk
Criterion 2: Reward per unit of total risk
Criterion 3: Reward per incremental unit of risk created by deviating from the benchmark's holdings

Exhibit 2 summarizes Spredeman's data. Both managers have the same benchmark and the risk-free rate for the evaluation horizon is 2%.

Exhibit 2
Performance Data for 5-Year Period ending 31 December 2016
(Annualized)

Performance Measure	**Manager 1**	**Manager 2**
Rate of return (%)	18.00	18.00
Sharpe ratio	1.02	1.05
Information ratio	1.38	0.72
Treynor measure (%)	16.67	14.95
Sortino ratio	0.50	0.52

C. **Determine**, for *each* criterion, the *most* appropriate performance measure from Exhibit 2. **Explain**, for *each* of these measures, the source of the difference in performance between the two managers.

9 minutes (Answer 3-C on page 20)

Answer Question 3-A on This Page

Determine which annualized return measure is higher for the period 2013−2016.
(circle one)

TWR MWR

Explain the cause of the difference between the account's TWR and MWR.

(Note: Calculations of TWR and MWR are not required.)

Answer Question 3-B on This Page

Determine which return measure is *more* appropriate to use in evaluating the external advisor's investment performance.
(circle one)

TWR MWR

Justify your response.

Answer Question 3-C on This Page

Criterion	**Determine**, for *each* criterion, the *most* appropriate performance measure from Exhibit 2.	**Explain**, for *each* of these measures, the source of the difference in performance between the two managers.
Criterion 1		
Criterion 2		
Criterion 3		

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QUESTION 4 HAS THREE PARTS (A, B, C) FOR A TOTAL OF 15 MINUTES.

Margaret Wald is an investor in the country of Commonland, where interest and dividends are taxed annually and capital gains are taxed only when realized. Both investment income and realized capital gains are taxed at a flat rate of 20%. Commonland's currency is the CLC.

Wald meets with her financial advisor to evaluate two new investment accounts, one holding only dividend-paying equities and one holding only non-dividend-paying equities. Each account is valued at CLC 100,000. Both accounts have an expected return of 8% per year and a cost basis of CLC 100,000. All of the return to the dividend-paying account is assumed to come from dividend income. Wald does not plan to make any contributions, withdrawals, or sales, and she will liquidate both accounts in 10 years.

Wald's advisor demonstrates that the future after-tax value of the dividend-paying account in 10 years is CLC 185,959 and that its accrual equivalent tax rate is 20%.

A. **Calculate** the accrual equivalent tax rate for the non-dividend-paying account. **Explain** the reason for the difference in future after-tax wealth between the two accounts. **Show** your calculations.

8 minutes (Answer 4-A on page 23)

Wald has a realized capital gain of CLC 50,000 in another taxable account. Her advisor reviews that account and notices that Stock Y has an unrealized loss of CLC 45,000 and a cost basis of CLC 220,000. The advisor explains two alternate plans to Wald:

Plan A: Sell Stock Y in Year 1 to realize the loss and replace it with Stock Z, which the advisor believes will have the same expected return as Stock Y. In Year 2, sell Stock Z at an expected market value of CLC 250,000.

Plan B: Hold Stock Y until Year 2 and then sell it at an expected market value of CLC 250,000.

B. **Demonstrate** that the amount of Wald's total two-year tax liability is the same for both plans. **Show** your calculations.

4 minutes (Answer 4-B on page 24)

Even though the two plans have the same total taxes, the advisor recommends Plan A. The advisor states that Plan A could increase Wald's expected after-tax account value at the end of Year 2.

C. **Explain** how Plan A could increase Wald's expected after-tax account value at the end of Year 2.

3 minutes (Answer 4-C on page 25)

Answer Question 4-A on This Page

Calculate the accrual equivalent tax rate for the non-dividend-paying account. **Explain** the reason for the difference in future after-tax wealth between the two accounts. **Show** your calculations.

Answer Question 4-B on This Page

Demonstrate that the amount of Wald's total two-year tax liability is the same for both plans.
Show your calculations.

Plan	Tax Liability Year 1	Tax Liability Year 2	Total Tax Liability Year 1 + Year 2
Plan A			
Plan B			

Answer Question 4-C on This Page

Explain how Plan A could increase Wald's expected after-tax account value at the end of Year 2.

QUESTION 5 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 15 MINUTES.

Laura Stone is a financial advisor at an investment firm with clients who are active traders. She determines that several of her clients routinely exhibit the behavioral biases shown in Exhibit 1.

Exhibit 1
Client Behavioral Biases

Client	Bias
Client 1	Conservatism
Client 2	Representativeness
Client 3	Confirmation
Client 4	Regret aversion
Client 5	Self-attribution

Stone believes that these clients act primarily on the basis of their biases. She schedules meetings with these clients to evaluate their investment portfolios and make recommendations.

Client 1 and Client 2
Both clients own shares in AERO, a company in the airline industry. AERO has experienced four years of earnings growth above the airline industry average. However, in the two most recent quarters, AERO's earnings have been below analysts' expectations.

A. **Determine**, based on their observed biases, whether *each* of the following clients will *most likely* hold or sell AERO:

i. Client 1
ii. Client 2

Justify *each* response.

6 minutes (Answer 5-A on page 28)

Client 3
Client 3 strongly prefers value investing and believes his portfolio is invested in a value style. Stone presents several updated valuation metrics for Client 3's portfolio and a broad market benchmark, as shown in Exhibit 2.

Exhibit 2
Client 3's Portfolio and Market Benchmark

Valuation Metric	Portfolio	Market Benchmark
Dividend yield	3.5%	2.0%
P/E ratio	20	15
Price/book ratio	2.5	2.4
EPS growth	11%	8%

B. **Determine**, based on his observed bias, whether Client 3 will *most likely* continue to believe that his portfolio is invested in a value style. **Justify** your response.

3 minutes (Answer 5-B on page 29)

Client 4 and Client 5

One year later, the equity market is up 30% and both trading volume and market volatility have increased. All client accounts have benefited and Client 4 has been actively buying equities as the market rises. Stone believes the market is overvalued and that the collective behavior of investors is contributing to the formation of a market bubble.

C. **Explain** how Client 4's trading behavior is consistent with his observed bias.

3 minutes (Answer 5-C on page 30)

D. **Determine**, based on her observed bias, whether Client 5 is *likely* to buy equities as the market rises. **Justify** your response.

3 minutes (Answer 5-D on page 31)

Answer Question 5-A on This Page

Client	**Determine**, based on their observed biases, whether *each* client will *most likely* hold or sell AERO. (circle one)	**Justify** *each* response.
i. Client 1	hold sell	
ii. Client 2	hold sell	

Answer Question 5-B on This Page

Determine, based on his observed bias, whether Client 3 will *most likely* continue to believe that his portfolio is invested in a value style. (circle one)	
Yes	No

Justify your response.

Answer Question 5-C on This Page

Explain how Client 4's trading behavior is consistent with his observed bias.

Answer Question 5-D on This Page

Determine, based on her observed bias, whether Client 5 is *likely* to buy equities as the market rises. (circle one)

Yes No

Justify your response.

QUESTION 6 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 22 MINUTES.

Fiona Patel, age 35, just retired from a successful career as a professional tennis player. She is meeting with her financial advisor to update her IPS.

Income
Patel receives a pension from the Professional Tennis Association during retirement. This annual payment will total 375,000 New Zealand dollars (NZD), pre-tax, in the coming year. In future years, this amount will be indexed for inflation, which is expected to be 1.25% per year. The pension is taxed at 33%.

Expenses
Patel's living expenses over the previous twelve months were NZD 400,000. She anticipates these expenses will grow at the expected rate of inflation this year and in each future year.

Assets
In addition to her pension payments, Patel has an advisor-managed investment portfolio currently valued at NZD 5,200,000. Next week, she intends to make a direct equity real estate investment of NZD 450,000 in a sports training facility. The real estate holding will be excluded from her advisor-managed investment portfolio. Also in the coming days, Patel will receive a performance cash bonus of NZD 1,100,000, and it will be immediately invested in her portfolio. This bonus and all investment returns are taxed at 33%.

Goals
Patel wants her portfolio to fund any expenses not covered by her pension, while maintaining its real value over time. She is eager to consider investments in more risky asset classes. Patel is not concerned about volatility in the value of her portfolio, as long as it continues to support her living expenses. She does not intend to seek further employment in retirement.

The advisor concludes that Patel's risk tolerance is above-average.

A. **Determine** Patel's nominal after-tax required rate of return for the coming year. **Show** your calculations.

Note: Assume that pension payments and ongoing expenses are end-of-year cash flows.

8 minutes (Answer 6-A on page 34)

B. **Identify** *three* factors that indicate Patel has a high ability to take risk.

3 minutes (Answer 6-B on page 35)

C. **Formulate** the constraints section of Patel's IPS for *each* of the following:

i. Time horizon
ii. Unique circumstances

4 minutes (Answer 6-C on page 36)

Ten years later, Patel sells her investment in the sports facility and adds the proceeds to her investment portfolio. She meets with her advisor to discuss three objectives for her portfolio and to review its allocation.

First, Patel requires a real after-tax return of 4.0% per year. Second, Patel wants to add exposure to alternative investments, provided that her total exposure to illiquid alternative assets is no more than 10% of the portfolio. Third, she would like her portfolio to have only a small probability of declining more than 11% (in nominal pre-tax terms) in any one year. The advisor describes how a normal distribution can be used to model portfolio returns. Patel agrees to a two-standard-deviation approach to monitor the shortfall risk of the portfolio.

The expected inflation rate is now 2.0% per year and her tax rate remains at 33%. Three strategic asset allocations under consideration are shown in Exhibit 1.

Exhibit 1
Patel Strategic Asset Allocation Choices

		A	B	C
Asset Class				
Traditional	Equities	50%	65%	55%
	Fixed income	26%	23%	25%
	Cash	2%	3%	3%
Alternative	Private equity	16%	6%	5%
	REITs	6%	3%	12%
Expected Return and Risk				
Pre-tax nominal annual return		10.7%	9.3%	9.1%
Nominal annual standard deviation		10.6%	10.3%	8.9%

D. **Determine** the *most* appropriate allocation from Exhibit 1 for Patel, given her three objectives. **Explain** why *each* of the other two allocations is *not* appropriate. **Show** your calculations.

7 minutes (Answer 6-D on page 37)

Answer Question 6-A on This Page

Determine Patel's nominal after-tax required rate of return for the coming year. **Show** your calculations.

(Note: Assume that pension payments and ongoing expenses are end-of-year cash flows.)

Answer Question 6-B on This Page

Identify *three* factors that indicate Patel has a high ability to take risk.

1.

2.

3.

Answer Question 6-C on This Page

Formulate the constraints section of Patel's IPS for *each* of the following:

i. Time horizon

ii. Unique circumstances

Answer Question 6-D on This Page

Determine the *most* appropriate allocation from Exhibit 1 for Patel, given her three objectives. (circle one)	**Explain** why *each* of the other two allocations is *not* appropriate. **Show** your calculations. (Note: For the two allocations *not* selected, the answer should be written in the box to the right of *each* of these allocations. For the allocation you selected, the box to the right should remain empty.)
A	
B	
C	

QUESTION 7 HAS THREE PARTS (A, B, C) FOR A TOTAL OF 14 MINUTES.

Maz Green is the market strategist for Atomic Capital, a global asset management firm. The firm attempts to increase returns by overweighting countries with higher expected growth in GDP. Green uses the Cobb-Douglas production function in his analysis, under an assumption of constant returns to scale. Green's forecasts for two developing countries are summarized in Exhibit 1.

Exhibit 1
Green's Long-term Economic Forecasts
(Annualized)

Factor	Country A	Country B
Growth in total factor productivity	2.0%	1.5%
Growth in capital stock	3.5%	2.5%
Output elasticity of labor	0.6	0.5

After making his forecasts, Green learns that the governments of Country A and Country B are implementing the following economic stimulus plans:

- Country A is introducing permanent tax incentives on new investments in plant and equipment. This is expected to increase the growth in capital stock from 3.5% to 5.5%.

- Country B is reducing trade barriers and removing restrictions on capital flows. This is expected to have the sustained effect of increasing growth in total factor productivity from 1.5% to 3.0%.

A. **Determine**, using the Cobb-Douglas production function, which country (A or B) will achieve a greater *increase* in real GDP growth as a result of its stimulus plan. **Justify** your response.

4 minutes (Answer 7-A on page 40)

Joseph Trek is a portfolio manager for the Atomic Balanced Fund. He adjusts the fund's allocation between equities and fixed income, based on his market outlook for Country Z. He applies the Cyclically Adjusted P/E Ratio (CAPE) to assess whether equities are overvalued or undervalued. Capital market data for Country Z are shown in Exhibit 2.

Exhibit 2
Capital Market Data for Country Z

Equity price index, real	975
P/E ratio, 1-year forward	15.3
Past 10-year average earnings, real	52.7
Past 10-year average earnings, nominal	68.3
Long-term average CAPE (100 years)	16.9

B. **Determine** whether Country Z's equity market is currently undervalued, fairly valued, or overvalued based on CAPE. **Justify** your response. **Show** your calculations.

4 minutes (Answer 7-B on page 41)

Trek questions whether CAPE is providing an accurate valuation signal for Country Z's equity market. He notes two events in particular and would like to determine whether they affect CAPE's valuation assessment.

Event 1: Country Z is emerging from a recession, which has an effect on current earnings and inflation.

Event 2: Country Z changed accounting rules in 2005 to require that changes in pension deficits and surpluses be included in current-period earnings going forward.

C. **Determine** whether *each* of the following *most likely* reduces the effectiveness of CAPE in assessing the valuation of Country Z's equity market:

i. Event 1
ii. Event 2

Justify *each* response.

6 minutes (Answer 7-C on page 42)

Answer Question 7-A on This Page

Determine, using the Cobb-Douglas production function, which country will achieve a greater *increase* in real GDP growth as a result of its stimulus plan.
(circle one)

A B

Justify your response.

Answer Question 7-B on This Page

Determine whether Country Z's equity market is currently undervalued, fairly valued, or overvalued based on CAPE.
(circle one)

undervalued fairly valued overvalued

Justify your response. **Show** your calculations.

Answer Question 7-C on This Page

Event	**Determine** whether *each* event *most likely* reduces the effectiveness of CAPE in assessing the valuation of Country Z's equity market. (circle one)	**Justify** *each* response.
i. Event 1	Yes No	
ii. Event 2	Yes No	

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QUESTION 8 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 20 MINUTES.

Rohan Roggen is the founder of a successful business in Europe. Roggen also created the Roggen Family Charitable Foundation (RFCF) to fund projects in perpetuity that will provide clean drinking water in developing countries.

RFCF's current portfolio is valued at EUR 250 million, with 50% in equities and 50% in fixed income. The portfolio's equity holdings are in a fund tracking a broad index of EUR-denominated stocks; the fixed-income holdings are in a fund tracking an all-maturity index of EUR-denominated government bonds. Roggen rebalances the foundation's portfolio every six months.

Roggen hires Michaela Loucks, an investment consultant, to advise on RFCF's asset allocation and investments. Roggen explains that he wants the foundation to achieve the following objectives:

- Spend at least 3% of the fund's beginning value on projects each year in order to satisfy a legal requirement.
- As part of this annual distribution, spend at least EUR 5 million (inflation-adjusted) each year on projects in emerging countries in Europe.
- Minimize the likelihood of a decline in the portfolio's value of more than 10% in any single year.

Loucks recommends that RFCF establish an IPS and globally diversify its portfolio. She discusses with Roggen the asset-only (AO) and asset/liability management (ALM) approaches to setting RFCF's policy asset allocation.

A. **Discuss** why *each* of the following approaches could be appropriate in setting RFCF's policy asset allocation:

i. AO
ii. ALM

6 minutes (Answer 8-A on page 46)

To better diversify the policy asset allocation globally, Loucks specifically recommends that Roggen consider adding the following four asset classes:

- Non-EUR developed market equities
- Emerging market equities
- Broad EUR fixed income, including government and credit
- Alternative investments, including real estate, commodities, and private equity

B. **Discuss**, with *two* reasons, why the set of six asset classes (current portfolio plus Loucks' recommendations) for the RFCF policy asset allocation are *not* appropriately specified.

4 minutes (Answer 8-B on page 47)

Using the data in Exhibit 1, Loucks evaluates whether adding an additional asset class to RFCF's portfolio will improve its risk-return characteristics. She assumes that inflation is 0.5%, the risk-free rate is 1.0%, and the correlation between the current portfolio and emerging market equities is 0.79.

Exhibit 1
Long-term Expectations

	Return	**Standard Deviation**
Current RFCF portfolio	4.5%	6.5%
Emerging market equities	7.5%	13.5%

C. **Determine**, based on mean-variance analysis, whether emerging market equities should be added to the current RFCF portfolio. **Justify** your response. **Show** your calculations.

4 minutes (Answer 8-C on page 48)

Loucks also evaluates available methods for determining the target asset class weights in the IPS. She decides to use a Monte Carlo simulation rather than single-period mean-variance optimization (MVO) to establish these target weights. She determines that RFCF has an above-average risk tolerance.

D. **Support**, with *two* reasons, Loucks' choice of Monte Carlo simulation, rather than MVO, to determine RFCF's target asset class weights.

6 minutes (Answer 8-D on page 49)

Answer Question 8-A on This Page

Discuss why *each* of the following approaches could be appropriate in setting RFCF's policy asset allocation:

i. AO

ii. ALM

Answer Question 8-B on This Page

Discuss, with *two* reasons, why the set of six asset classes (current portfolio plus Loucks' recommendations) for the RFCF policy asset allocation are *not* appropriately specified.

1.

2.

Answer Question 8-C on This Page

Determine, based on mean-variance analysis, whether emerging market equities should be added to the current RFCF portfolio.
(circle one)

Yes No

Justify your response. **Show** your calculations.

Answer Question 8-D on This Page

Support, with *two* reasons, Loucks' choice of Monte Carlo simulation, rather than MVO, to determine RFCF's target asset class weights.

1.

2.

QUESTION 9 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 21 MINUTES.

Smixon Resources, a mining company, contacts fixed-income consultant Hamel Carter. Smixon recently acquired a mine along with the associated liability to pay its reclamation costs. Carter is asked to construct a portfolio that will fund Smixon's liability, which will be payable in full at the end of the mine's life in 10 years. The objective for the portfolio is to immunize the liability while minimizing reinvestment risk.

Carter reviews three potential portfolios shown in Exhibit 1. The initial value of each portfolio equals the present value of the estimated reclamation costs.

Exhibit 1
Potential Portfolios for Smixon

Portfolio	Duration	Spread Duration	Average Maturity (Years)	Average Coupon
1	10.00	4.33	13.44	5.19%
2	10.00	2.00	13.25	4.91%
3	8.00	6.80	10.00	4.85%

A. **Select** the portfolio that is *most* appropriate, given the stated objective. **Explain** why *each* of the other two portfolios is *less* appropriate.

5 minutes (Answer 9-A on page 52)

Carter reviews the bonds in a different Smixon portfolio shown in Exhibit 2. He wants to rebalance the portfolio's dollar duration to 240,000 Canadian dollars (CAD) while maintaining the existing security weights.

Exhibit 2
Smixon Portfolio Holdings

Security	Price	Market Value (in CAD)	Duration
Canadian government bond	96.42	771,360	11.2
Denton Corp. bond	95.00	855,000	9.4
Generation Corp. bond	104.00	728,000	9.1
Total	---	2,354,360	---

B. **Calculate** the amount (in CAD) of cash required to rebalance the portfolio's dollar duration. **Show** your calculations.

5 minutes (Answer 9-B on page 53)

Several years later, Carter is asked to structure a new low-risk portfolio of CAD-denominated bonds that will be used to fund Smixon's contributions to a new environmental research project. Smixon will contribute CAD 3 million to the research project once a year for the next 7 years, with the first payment due one year from now.

Carter wants to identify a portfolio that will immunize the schedule of liabilities, assuming a parallel shift in the yield curve. The liabilities have an average maturity of 4.0 years and a composite duration of 3.8. Possible portfolio choices are shown in Exhibit 3. For each portfolio, the present value of the assets equals the present value of the liabilities.

Exhibit 3
Portfolio Choices

	A	**B**	**C**	**D**
Bond maturity, in years				
Shortest	1.15	1.13	0.90	0.97
Longest	8.42	8.11	7.17	7.75
Bond duration				
Lowest	1.03	0.91	0.85	0.92
Highest	7.90	7.30	6.85	7.15
Composite duration	4.00	3.80	3.80	4.00

C. **Select** the portfolio that will be *most* effective at immunizing Smixon's liability schedule. **Justify** your response.

Note: No calculations are required.

5 minutes (Answer 9-C on page 54)

Carter also manages several active strategies and is evaluating two trade ideas for his portfolios. His forecast, which differs from consensus, is that the economy will weaken and that the yield curve will experience a parallel downward shift.

Trade 1: Buy a 10-year AA-rated non-callable corporate bond;
Sell a 10-year AA-rated callable bond of the same issuer.

Trade 2: Buy a 5-year floating-rate corporate bond;
Sell the same issuer's 5-year fixed-rate bond.

D. **Determine**, assuming Carter's forecast is correct, whether he should execute *each* of the following:

i. Trade 1
ii. Trade 2

Justify *each* response.

6 minutes (Answer 9-D on page 55)

Answer Question 9-A on This Page

Select the portfolio that is *most* appropriate, given the stated objective. (circle one)	**Explain** why *each* of the other two portfolios is *less* appropriate. (Note: For the two portfolios *not* selected, the answer should be written in the box to the right of *each* of these portfolios. For the portfolio you selected, the box to the right should remain empty.)
1	
2	
3	

Answer Question 9-B on This Page

Calculate the amount (in CAD) of cash required to rebalance the portfolio's dollar duration. **Show** your calculations.

Answer Question 9-C on This Page

Select the portfolio that will be *most* effective at immunizing Smixon's liability schedule.
(circle one)

A B C D

Justify your response.

(Note: No calculations are required.)

Answer Question 9-D on This Page

Trade	**Determine**, assuming Carter's forecast is correct, whether he should execute *each* trade. (circle one)	**Justify** *each* response.
i. Trade 1	Yes No	
ii. Trade 2	Yes No	

QUESTION 10 HAS FOUR PARTS (A, B, C, D) FOR A TOTAL OF 17 MINUTES.

Bridget Brink works in the risk management department at Keynote, a multi-strategy hedge fund. Brink is preparing a risk analysis for two Keynote funds, Fund X and Fund Y.

Brink uses the variance-covariance method to estimate the weekly VaR for Fund X. She assumes returns are normally distributed and uses a z-value of 1.65 for a 5% probability. Summary statistics and capital market expectations appear in Exhibit 1.

Exhibit 1
Summary Statistics and Capital Market Expectations for Fund X

	Developed Market Bonds	**Developed Market Equities**
Target portfolio weight	60%	40%
Expected annual return	8%	14%
Expected annual standard deviation	10%	16%
Expected correlation between developed market bonds and developed market equities	0.50	
Portfolio beta	0.78	
Portfolio size	USD 100 million	

A. **Calculate** the 5% weekly VaR (in USD) for Fund X using the variance-covariance method. **Show** your calculations.

6 minutes (Answer 10-A on page 58)

Brink presents an alternative approach to estimate VaR, the historical method, for Fund Y. Fund Y has assets of USD 175 million and routinely uses speculative option positions to increase returns. This results in the fund having a non-normal return distribution. Fund Y invests only in equities of the country of Aster. Recently, Aster enacted a fiscal stimulus program which included corporate tax reform. Brink believes the changes will have a long-term positive effect on returns in Aster's equity market.

Brink's historical VaR analysis indicates that Fund Y's average monthly return over the past 10 years is 0.86% with a monthly standard deviation of 3.10%. The 10 worst monthly returns during that period are shown in Exhibit 2.

Exhibit 2
Ten Worst Monthly Returns for Fund Y over the Past 10 Years

Jul 2008	Aug 2008	Sep 2009	Sep 2011	Sep 2013	Dec 2008	Jun 2009	Oct 2008	Jun 2011	Aug 2013
–8.2%	–4.8%	–4.6%	–3.5%	–3.3%	–3.2%	–2.9%	–2.4%	–2.0%	–1.8%

B. **Calculate** the 5% monthly VaR (in USD) for Fund Y using the historical method. **Show** your calculations.

3 minutes (Answer 10-B on page 59)

C. **Discuss** *one* reason why the historical method might *not* be appropriate for Fund Y.

3 minutes (Answer 10-C on page 60)

Brink considers performance evaluation measures for the Keynote funds. She believes that portfolio managers should not be penalized for volatility associated with positive performance. Brink also believes portfolio managers should not be rewarded when their annual returns are lower than the risk-free rate. However, she is not concerned when a fund deviates from its benchmark.

Brink compares three risk-adjusted performance evaluation measures: Sharpe ratio, information ratio, and Sortino ratio.

D. **Determine**, based on Brink's beliefs and concern, which performance measure (Sharpe ratio, information ratio, Sortino ratio) is *most* appropriate. **Explain**, for *each* of the two measures *not* selected, why they are *less* appropriate.

5 minutes (Answer 10-D on page 61)

Answer Question 10-A on This Page

Calculate the 5% weekly VaR (in USD) for Fund X using the variance-covariance method. **Show** your calculations.

Answer Question 10-B on This Page

Calculate the 5% monthly VaR (in USD) for Fund Y using the historical method. **Show** your calculations.

Answer Question 10-C on This Page

Discuss *one* reason why the historical method might *not* be appropriate for Fund Y.

Answer Question 10-D on This Page

Determine, based on Brink's beliefs and concern, which performance measure is *most* appropriate. (circle one)	**Explain**, for *each* of the two measures *not* selected, why they are *less* appropriate. (Note: For the two measures *not* selected, the answer should be written in the box to the right of *each* of these measures. For the measure you selected, the box to the right should remain empty.)
Sharpe ratio	
information ratio	
Sortino ratio	

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