CURATED PAST EXAM ITEMS
- Questions -

INV 101 – Portfolio Management

Important Information:

- These curated past exam items are intended to allow candidates to focus on past SOA fellowship assessments. These items are organized by topic and learning objective with relevant learning outcomes, source materials, and candidate commentary identified. We have included items that are relevant in the new course structure, and where feasible we have made updates to questions to make them relevant.
- Where an item applies to multiple learning objectives, it has been placed under each applicable learning objective.
- Candidate solutions other than those presented in this material, if appropriate for the context, could receive full marks. For interpretation items, solutions presented in these documents are not necessarily the only valid solutions.
- Learning Outcome Statements and supporting syllabus materials may have changed since each exam was administered. New assessment items are developed from the current Learning Outcome Statements and syllabus materials. The inclusion in these curated past exam questions of material that is no longer current does not bring such material into scope for current assessments.
- Thus, while we have made our best effort and conducted multiple reviews, alignment with the current system or choice of classification may not be perfect. Candidates with questions or ideas for improvement may reach out to education@soa.org. We expect to make updates annually.

INV 101
LEARNING OBJECTIVE 1

CATEGORIZED PAST EXAM QUESTIONS

These questions are representative of those which may be asked of candidates sitting for the INV 101 Portfolio Management assessment. These questions are intended to represent the depth of understanding required of candidates. Illustrative Solutions are provided separately.

The questions from this study note are taken from past SOA examinations. Most of these questions are taken from the previous QFI PM examinations. Sub-parts of a question were removed or struck-through if the reference material no longer appears on the current Syllabus.

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1. QFI PM Fall 2020, Question 2

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021, Ch 23

You are an actuary working for the CFO of XYZ Insurance Company. XYZ has substantial liability payments in 6 years and is interested in commercial real estate investments.

The CFO told you that within the commercial mortgage industry an important division occurs between two types of mortgage loans from the point of view of the loan's purpose.

(a) Compare and contrast the default and interest rate risks of these two main types of mortgage loans.

ANSWER:

XYZ is considering allocating a significant portion of its portfolio into one of the following two CMBS: CMBS-I and CMBS-II.

	CMBS-I	CMBS-II
Tranche A (investment grade)	\$200M par value 5% coupon rate	\$220M par value 5% coupon rate
Tranche B (below-investment grade)	\$50M par value 8% coupon rate	\$80M par value 8% coupon rate
Tranche X (interest only)	\$250M notional par 1.4% coupon rate first 4 years, 1.0% coupon rate thereafter	\$300M notional par 1.5% coupon rate first 7 years, 1.1% thereafter
Frequency of coupon payments	Annual, payable in arrears	Annual, payable in arrears

Mortgages backing the CMBS	A pool of 5 mortgages, with 2 maturing in 4 years, and 3 maturing in 6 years: • Each with $50M loan balance and the same coupon rate • Mortgages are Interest-Only with all principal payable on maturity	A pool of 3 mortgages, with 1 maturing in 7 years, and 2 maturing in 10 years: • Each with $100M loan balance and the same coupon rate • Mortgages are Interest-Only, with all principal payable on maturity
Total market value of the underlying properties	$400M	$450M

~~(b) Recommend which CMBS to purchase based on:~~

~~(i) Loan-to-Value ratio~~

~~(ii) Weighted Average Maturity~~

~~ANSWER:~~

XYZ decided to purchase a 50% share in Tranche A of CMBS-I for $100M. There was no default in the first 4 years.

(c) Calculate the subordination of Tranche A at the beginning of Year 5.

ANSWER:

At the beginning of Year 6 the 3 remaining mortgages have not defaulted, the market value of XYZ's remaining holding in CMBS-I is $48M. You believe there are two possible scenarios regarding the underlying mortgages of CMBS-I:

- Scenario 1 (60% probability): Two mortgages default during the year, with the CMBS servicer being able to recover a total amount of $45M in respect of these two mortgages at the end of Year 6. The remaining mortgage is paid off as expected at the end of Year 6.
- Scenario 2 (40% probability): All mortgages are paid off on schedule.

The CFO is considering two action plans at the beginning of Year 6:

- Plan A: Hold CMBS-I to maturity. Assume all principal and interest payments collected on the mortgages are fully distributed to CMBS holders, i.e. there are no fees, servicing costs or other expenses.
- Plan B: Sell all CMBS-I at market value and reinvest the proceeds in a 1 Year Treasury Bill with 2.5% annual return. Assume there are no additional expenses and no default or tax impact.

(d) Recommend which action plan to take based on the expected Holding Period Return in Year 6.

ANSWER:

2. QFI PM Fall 2020, Question 3

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021, Ch 11; INV101-102-25: High-Yield Bond Primer

You work for insurance company ABC, which has a significant amount of assets under management and expertise in investing in leveraged loans. You are looking to sell leveraged loans on the secondary market via either assignment or participation. Your company and the prospective buyers are on good terms with the borrowers. Your company is looking to achieve the best price on the sale.

(a) Recommend how the company should seek to sell the loans via assignment or participation.

ANSWER:

The CIO likes the fundamentals of leveraged loans and believes the company has a competitive advantage in identifying attractive deals in leveraged loans, but feels that regulatory required capital requirements are too high relative to other asset classes. ABC does not calculate economic capital. The CIO asked you to explore alternative asset classes including CLOs and High Yield Bonds.

(b) Explain two ways by which the creation of a CLO would likely add value for ABC.

ANSWER:

A colleague states: "Though the equity tranche is at the bottom of the capital structure of a CLO, it is not as risky as it seems. In the case of bankruptcy, the absolute priority rule is often violated, therefore the equity tranche is likely to receive some payment before the senior tranches are paid in full."

(c) Critique your colleague's statement regarding CLOs.

ANSWER:

The CIO has supplemented the company's investment in leveraged loans with an allocation to high yield bonds. The CIO is concerned about the company's interests in the event the borrower's financial condition deteriorates. Your colleague has suggested researching the following characteristics of high yield bonds:

- Put provisions
- Call protection
- Bullet structure
- Equity warrants

(d) Explain whether each characteristic would address the CIO's concern.

ANSWER:

The CIO is considering the following asset classes:

- Leveraged Loans
- High Yield Bonds

The CIO states the following:

- "Credit risk is attractively priced and we should maintain exposure to credit risk."
- "To duration match the liabilities, we should invest in fixed-rate assets with as long maturities as possible."
- "We have a competitive advantage in navigating bankruptcies to maximize recovery rates."

(e)

(i) Assess whether each of the asset classes is appropriate in the context of each the above statements.

(ii) Recommend one of the asset classes.

ANSWER:

3. QFI PM Fall 2020, Question 8

Learning Outcome(s): 1b, 2k

Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 19 Portfolio Performance Evaluation

You are the portfolio manager responsible for managing the investment portfolio for an insurance company, focusing on bonds and equities. Your chief risk officer (CRO) wants to diversify the portfolio by adding alternative investments. She is interested in two types of hedge fund investment: Hedged equity and Fund of funds.

(a) Describe:

(i) Key features of these two types of hedge fund investments

ANSWER:

Your colleague proposes to use managed futures rather than hedge funds for the following reasons:

1. Unlike hedge funds, which are only available to accredited investors, managed futures are open to broader range of investors and hence are considered to be more liquid.
2. Compensation arrangements tend to be less expensive for managed futures than hedge funds.
3. Managed futures focus on broader macro equity and bond markets whereas hedge funds look for inefficiencies in micro levels of equity and bond markets, so managed futures are easier to trade.
4. Managed futures are very active in spot markets whereas hedge funds mostly trade in derivative markets for hedging purposes.
5. Managed futures are usually less regulated than hedge funds.

(b) Critique your colleague's proposal and the reasons given.

ANSWER:

Your CRO has drafted an investment objective for adding investments to the existing portfolio, which is to maximize the Sharpe ratio and expect to achieve consistent positive returns. She asked you to use the following information and provide her a recommendation:

	Portfolio A: Current Portfolio	Hedge Fund	Managed Futures	Portfolio B: 90% Portfolio A +10% Hedge Fund	Portfolio C: 90% Portfolio A +10% Managed Futures

Expected return	6%	12%	9%		
Std. dev. of return	12%			10%	9%
Skewness of return	-1			-0.9	0.3

- Risk-free interest rate is 3.6%;

(c) Recommend a portfolio from the table above based on her drafted investment objective.

ANSWER:

As part of the due diligence, you mention to your CRO that the Sharpe ratio may not be a good performance assessment measure as it has a number of limitations. One limitation is that the reported Sharpe ratio can be artificially increased without the investment delivering higher risk-adjusted returns.

(d) Describe three ways that the Sharpe ratio can be gamed.

ANSWER:

4. QFI PM Fall 2020, Question 16

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021, Ch 60

You work for ABC bank which is involved in fixed income securities trading. You purchased a Treasury note and plan to hold it for one day.

(a)

(i) Explain how an overnight repurchase agreement works.

(ii) Explain why it would be a more cost efficient way to finance this purchase, instead of using the bank's own funds.

ANSWER:

(b) Explain how two common practices are used to reduce credit risk in repurchase agreements.

ANSWER:

ABC bank also deals in Mortgage Backed Securities (MBS) and is considering a collateralized loan to cover a short position in their securities.

(c)

(i) Describe a dollar roll transaction

(ii) Explain how it differs from repo agreement.

ANSWER:

5. QFI PM Spring 2021, Question 4

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18, Ch 19

You are the investment actuary in XYZ corporate pension plan with 1.2 billion in total assets under management. The status of the pension plan is the following:

1. It is open to new members.
2. The average age of its members is 44 years old.
3. It has 20% of the asset invested in public equities.

(a) Evaluate the suitability of allocating 5% of its asset portfolio to private equity investments to increase its overall returns and portfolio diversification.

ANSWER:

The CEO is a bit confused about the following information about Fund ABC and asks you to provide explanations.

Fund ABC, a private equity fund, has gross annual returns of 12.7%, 4.5%, and 7.8% reported in each of the past three years. Its management fee is 2%, carried interest is 20% with a preferred return of 6%.

(b) Explain the fee structure of a private equity fund

ANSWER:

(c) Estimate ABC's average net annual return for the past three years.

ANSWER:

(d) Evaluate the differences between the direct and indirect private equity investments

(e) Recommend a private equity investment for the pension plan.

ANSWER:

The CEO chooses to pursue direct private equity investment in order to push for dividend recapitalization to boost the investment returns.

(f) (*1 point*) Critique the CEO's choice.

ANSWER:

6. QFI PM Spring 2021, Question 5

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021, Ch 10

A 2-year bond is issued with semi-annual coupons at a bond equivalent yield (BEY) of 3%. You are given the following yields.

Yield to maturity (BEY) 4.0%

Yield to call (BEY) 6.0%

The bond is to be called at the end of 1 year.

Calculate the call price of the bond

ANSWER:

7. QFI PM Fall 2021, Question 4

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18

ABC is an insurance company whose assets are currently invested in fixed income instruments. The Company has developed an interest in private equity (PE) investments; in particular, venture capital (VC) investments. As an investment actuary, you are asked to make some suggestions.

(a) Define the VC investment strategy.

ANSWER:

(b) Explain why it is more difficult to manage and value VC investments by traditional techniques compared to fixed income assets.

ANSWER:

~~You are helping to prepare the limited partnership agreement (LPA). The LPA lays out conditions aimed at discouraging the general partner from moral hazard and adverse selection.~~

~~(c) Compare and contrast moral hazard and adverse selection with examples.~~

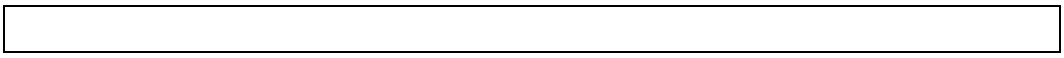
~~ANSWER:~~

You are helping to prepare the limited partnership agreement (LPA). The LPA lays out conditions aimed at discouraging the general partner from moral hazard and adverse selection.

The Company invests $200 million in a portfolio company at the beginning of the year and exits by selling it for $300 million. The LPA defines the following distribution waterfall. A 15% hurdle rate, an 100% catch-up, and a 75/25 carry split.

(d) Calculate the distribution of sale proceeds between the limited partner and the general partner.

ANSWER:



~~The Company has built a good relationship with the fund manager through previous investments. The management now considers exploring different routes for investing in PE. They have the following specific requirements.~~

- ~~Avoid cash-burning stage.~~
- ~~Focus on life science industry so the in-house insurance expertise will add value.~~
- ~~Reduce the information asymmetry in the investment process.~~

~~Four different routes for investing in private equity are available for the Company: PE fund, fund of funds, direct investment, and co-investment.~~

~~(e) Recommend the best route for investing in private equity, based on the Company's requirements.~~

~~ANSWER:~~

8. QFI PM Fall 2021, Question 9

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16

You are asked to review a commercial mortgage loan issued by your company. There is concern the borrower may not repay the loan.

(a)

(i) Describe possible non-litigious options you could consider.

(ii) Describe steps of litigious actions you could take.

ANSWER:

The borrower is a “single-asset” wealth-maximizing borrowing entity of sufficient size such that it can pay or prepay this loan. The loan is non-recourse and has one payment remaining of 800,000 due one year from now. The borrower has the right to prepay the mortgage today. One year from today, there are only three possible scenarios for the underlying value of the property.

Scenario 1 - 1,000,000
Scenario 2 - 850,000
Scenario 3 - 700,000

If foreclosure occurs, the costs paid to third parties will be 150,000.

If the borrower decided to pursue a strategic default situation, it is expected the borrower and lender would agree to equally share the difference between the amount owed and what the lender would receive in the event of a default.

(b) Describe four ways to mitigate the prepayment and/or credit risks of this loan at issue.

ANSWER:

Assume in each scenario above the borrower has not prepaid prior to the end of the year.

(c) Explain the course of action the borrower should take in each scenario above.

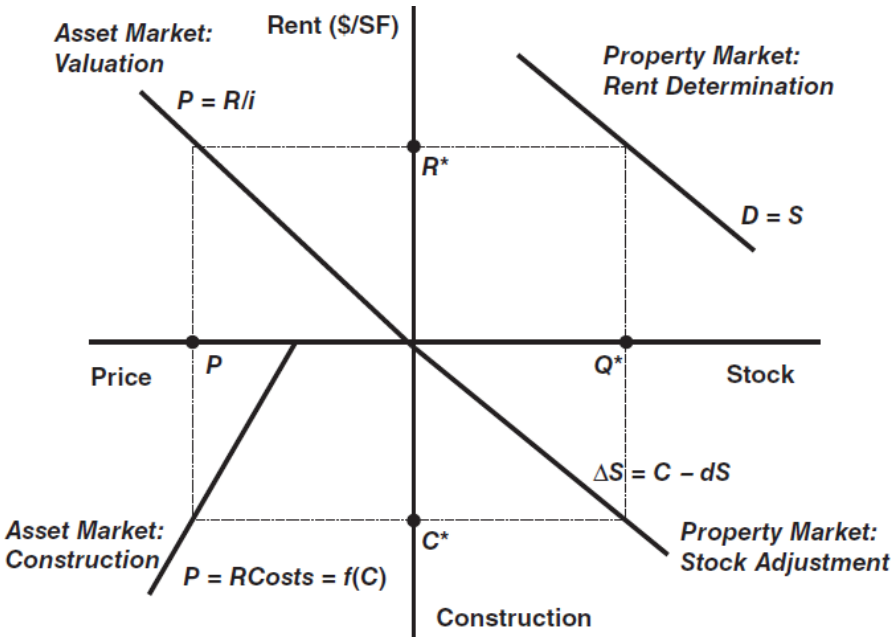
ANSWER:

9. QFI PM Spring 2022, Question 2

Learning Outcome(s): 1b

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12

The ABCD Pension Fund portfolio owns a real estate holding in a local market currently experiencing expanding economic activity. It is evaluating the sale of this property.



Using the Four-Quadrant model:

(a) Explain how increased economic activity drives rent in the short term.

ANSWER:

(b) Explain how increased economic activity drives construction activity and rent in the intermediate term.

ANSWER:

A semiconductor fabrication company is seeking to build a campus that would in part be comprised of a facility currently owned by ABCD.

(c) Explain investment value (IV) considerations for different investors and developers in a given geographic area.

ANSWER:

Let IV be the investment value of the property for the semiconductor company. Consider the following scenarios:

(i) Scenario 1: IV is much greater than market value (MV). To assemble the properties for an industrial campus, the potential buyer has larger plans than is possible for this single property, and thus a higher IV than the general MV of this specific property.

(ii) Scenario 2: IV is much less than MV. Selling specific properties, including the one owned by the pension plan, is more valuable than one large commercial space.

(iii) Scenario 3: IV roughly equals MV, within transaction costs.

(d) Propose a negotiating strategy for ABCD to sell the property to the semiconductor company for more than the general market price for each of the scenarios above.

ANSWER:

10. QFI PM Spring 2022, Question 13

Learning Outcome(s): 1a

Source Materials: INV101-101-25: Overview of Investing in Private Corporate Debt; INV101-102-25: High-Yield Bond Primer; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Ed, 2021 Ch 10

You are part of a team managing a fixed income portfolio backing long duration life insurance liabilities of ZZZ Life Insurance. The team is looking at ways to increase the overall yield of the portfolio using fixed income securities.

(a) Identify four advantages of private debt over high yield bonds.

ANSWER:

To illustrate to the team the different characteristics of high yield bonds you compare a pay-in-kind (PIK) note that has an equity clawback to a bond with a bullet structure.

(b) Compare and contrast the cash flows for a PIK note with an equity clawback and a bond with a bullet structure.

ANSWER:

The investment team has secured a loan using just a few of its higher quality industrial bonds as collateral. The collateral is marked to market once per month and must cover the amount of the loan outstanding plus a margin of 10%. If the collateral is insufficient, additional bonds are posted as collateral until the loan outstanding plus 10% is reached.

A rating agency recently informed the team that any additional posting of collateral for this loan could result in a downgrade of ZZZ Life Insurance. Additionally, over the past few weeks there has been a significant increase in merger and leveraged buyout activity in the industrial sector.

(c) Explain the event risk the team is concerned about due to this recent increase in merger and buyout activity with regards to the rating of ZZZ Life Insurance.

ANSWER:

You have been reading through the indentures of the industrial bonds pledged as collateral

(d) Explain two covenants that may appear in the indentures that would make you less concerned about the recent increase in merger and buyout activity.

ANSWER:

11. QFI PM Spring 2022, Question 17

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021 Ch 21

You work for the Asset & Liability Management (ALM) department for an insurance company. Your job is to design strategies to purchase various assets to back insurance liabilities. Based on the calculation from the actuaries, the duration for the liability is approximately 15 years. Your team member has the following comment:

Since the liability has a duration of 15 years, we can duration-match the liability by purchasing a Mortgage Backed Security (MBS) which uses 15 year fixed-term mortgages as the underlying asset. Since the mortgage rate is locked in at issue for fixed rate mortgages, as long as we can purchase MBS with the right interest rate, we can eliminate the interest rate risk.

(a) Critique his comment.

ANSWER:

Your colleague assembled the following analysis on the price vs interest rate of a Fixed-Maturity Bond and a MBS, but he forgot to label the securities.

Interest Rate	2.5%	3%	3.5%	4%	4.5%	5%	5.5%
Security A	106	104	102	100	98	96	94
Security B	104	103	101.5	100	97.5	95	93

(b) Describe the characteristics of Securities A and B to identify which is the Fixed-Maturity Bond and which is the MBS.

ANSWER:

Your firm is considering investing in a pool of mortgages with a weighted average coupon (WAC) of 5%.

There is a difference between the WAC and the pool's coupon rate.

(c) Explain three sources for the difference between the WAC and a pool's coupon rate.

ANSWER:

You were also given the underwriting information on two MBS pools. The information below are pool averages:

	MBS A	MBS B
Credit Score	760	700

Loan-to-Value Ratio	80%	85%
Debt-to-Income Ratio	30%	40%

(d)

(i) Explain how this information could be used to determine the credit risk of MBS.

ANSWER:

(ii) Identify which pool has a higher likelihood of default.

ANSWER:

12. QFI PM Fall 2022, Question 8

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021 Ch 10

Company XYZ is considering issuing a bond, expected to be rated BBB. The company has an option of issuing the bond with either a make-whole call provision or a fixed-price call.

(a) Contrast a make-whole call provision and a fixed-price call.

ANSWER:

XYZ issued a 10-year bond with a make whole call provision until year 7.5 as follows:

(i) Par value = $100,000.
(ii) Annual Coupon = $6,000, payable at the end of the year.

Selected constant-maturity Treasury (CMT) published by the Treasury at the end of 7.5 years are as follows:

Duration	**6 Mo CMT**	**1 Yr CMT**	**3 Yr CMT**	**7 Yr CMT**	**10 Yr CMT**
Current Rate	**0.48**	**1.00**	**1.20**	**2.40**	**3.00**

PV factors which discount future cashflows to yr 7.5 are provided below:

Year	End of year 8	End of year 9	End of year 10
Cashflow	1	1	1
Discount rate	PV of cashflows to yr 7.5		
1.00	2.956		
1.05	2.953		
1.10	2.951		
1.15	2.949		
1.20	2.947		
1.25	2.945		
1.30	2.943		
2.40	2.896		
2.50	2.892		
2.60	2.887		
2.70	2.883		
2.80	2.879		
2.90	2.875		
3.00	2.871		

7.5 years after the issue of the bond with a make-whole call provision, XYZ is considering exercising their option to redeem their bond.

(b) Calculate the call price.

ANSWER:

XYZ allowed the option to expire and immediately declares a tender offer lasting 6 months using a fixed spread of 12bps. At the end of the 6-month period, selected CMTs published by the treasury are as follows:

Duration	**6 Mo CMT**	**1 Yr CMT**	**3 Yr CMT**	**7 Yr CMT**	**10 Yr CMT**
Current Rate	**0.48**	**0.80**	**0.96**	**1.86**	**1.92**

(c) (*1.5 points*)

(i) Calculate the tender offer price, at the end of year 8, after the coupon payment has been made.

ANSWER:

(ii) Describe the advantages of using a tender offer.

ANSWER:

The rating agencies downgrade the bond to “B” and XYZ would like to issue additional bonds.

(d) (*1 point*) Describe three different kinds of bonds with deferred coupon structures that XYZ can issue to reduce their debt burden.

ANSWER:

(e) (*1 point*) Revise the following incorrect statements:

(i) An extendible reset bond allows the issuer to reset the bond at a fixed spread over the reference rate, with the index spread being specified in the indenture.

ANSWER:

(ii) In modern practice, if a term bond maybe be paid off by a sinking fund, that means that the issuer accumulates a fund in cash or in assets readily sold for cash, that is used to pay bonds at maturity.

ANSWER:

(iii) High yield bonds are debt instruments coupled with a derivative position, such as options, forwards, swaps, caps and floors.

ANSWER:

(iv) Credit spread is due exclusively to the corporate bond's exposure to credit risk.

ANSWER:

13. QFI PM Fall 2022, Question 9

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 21

You work at a bank that originates residential mortgage loans. You have been asked by your manager to analyze the feasibility of issuing non-agency Residential Mortgage-Backed Securities (RMBS).

(a) Explain four factors that are considered in the evaluation of the creditworthiness of a potential borrower.

ANSWER:

~~Five years ago the bank issued a large number of option adjustable-rate mortgage (OARM) loans that are similar to each other and are still outstanding. You would like to package these loans together to issue a non-agency RMBS.~~

~~(b) Describe four capital structure features that can be utilized to manage the risks of this non-agency RMBS.~~

~~ANSWER:~~

~~(c)~~

~~(i) Recommend an internal credit enhancement structure.~~

~~ANSWER:~~

~~(ii) Explain the mechanics of your recommended structure.~~

ANSWER:

(d) Describe four reasons which would explain why prepayments slowed down.

ANSWER:

14. QFI PM Fall 2022, Question 11

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18

A defined benefit pension plan of company XYZ invests mainly in long-term bonds and public stocks because the company has mostly young workers.

The pension committee wishes to test out an allocation to private equity investments. Your expertise will guide the decisions for this experiment.

A committee member suggests that younger venture capital firms offer an attractive return to investors because they pursue the goal of rapid IPOs of start-up companies; however, some studies suggested that this approach may negatively impact the returns of private equity.

(a) Describe two concerns about young venture capital funds that focus on rapid IPOs with respect to the returns of private equity.

ANSWER:

Senior management wants to learn more about the characteristics of venture capital investments.

(b) Describe the J-curve effect.

ANSWER:

Senior management is concerned about the high fees general partners charge for venture capital investments. You are asked to prepare a response.

(c) Justify the contribution of the general partner to the investment process.

ANSWER:

You are analyzing venture capital investments from the following perspectives:

- investment return
- time horizon
- liquidity
- diversification

(d)

(i) Describe two characteristics of venture capital investments for each perspective.

ANSWER:

(ii) Evaluate whether the venture capital investments are appropriate for the pension plan for each perspective.

ANSWER:

Senior management has asked you to consider two venture capital investment vehicles: limited partnership and limited liability companies.

(e) Recommend a vehicle for the pension plan.

ANSWER:

15. QFI PM Spring 2023, Question 6

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16

You are a consultant who has been hired by XYZ Assurance, a small life insurance company, to provide investment expertise. XYZ primarily offers 10 year term insurance, but has recently started to write universal life products. XYZ is hoping that offering permanent products such as universal life may provide an opportunity to improve their portfolio yield.

At your first meeting, XYZ's investment team shares ideas among themselves. A junior member suggests purchasing mortgage debt, and your boss asks for your opinion.

(a) Describe three differences between residential and commercial mortgages.

ANSWER:

(b) Identify four typical mortgage covenants.

ANSWER:

(c) Describe the borrower's put option in a non-recourse mortgage.

ANSWER:

16. QFI PM Spring 2023, Question 10

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 60

You are a portfolio manager for a long-term investor who is considering purchasing 20-year US-Treasury notes with a par value of $5 million and a coupon of 7% paid annually. The prevailing market interest rate is 3%. You would like to fund a position in three days using these securities as collateral.
You contract with manager Y to borrow the funds needed.

(a) Describe how you would construct a repurchase agreement.

ANSWER:

You contract with manager Z to borrow the funds needed.

(b) Describe how you would construct a securities lending agreement.

ANSWER:

Suppose you instead purchase Treasury Inflation-Protected Securities (TIPS) bonds with a 20-year maturity with a par value of $5 million, a TIPS real yield of 3%, risk adjusted break-even inflation rate of 3.1%, and nominal yield of 7%.

(c) Calculate the risk premium embedded in the bonds.

ANSWER:

(d) Explain why the portfolio manager would consider the TIPS bonds over the US Treasury notes.

ANSWER:

17. QFI PM Spring 2023, Question 12

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 19

(a) Define leveraged buyouts (LBOs).

ANSWER:

An LBO firm offers $900 million to purchase the equity of Company A and to pay off the outstanding debt. The $900 million LBO is financed with $800 million in debt and $100 million in equity. By foregoing dividends and using the free cash flow to pay down the existing debt, the management of the company can own the company free and clear in nine years. Use a long-term growth rate of 4% per year and a discount rate of 12%. EBITDA represents the free cash flow from operations that is available to the owners and debtors of the company.

Company A	In $ millions
Market value of Equity	600
Face value of Debt	200
EBITDA	180
EBITDA after LBO	200

(b) Calculate the annual compounded return for this investment.

ANSWER:

(c) Identify four methods that the management of the company can use to realize the value of the LBO deal.

ANSWER:

The LBO firm now considers two new buyout candidates, Company B and Company C. During last year, Company B shares declined approximately 17% and Company C shares move up approximately 2%.

Income Statement (In $ thousands)	**Company B**	**Company C**	**Balance Sheet (In $ thousands)**	**Company B**	**Company C**
Net sales	16,000	19,000	Current assets	6,000	5,000
Less cost of goods sold	10,000	14,000	Noncurrent assets	3,500	6,000
Less selling & admin.	4,000	3,000	Other assets	400	200
Operation income	2,000	1,800	Total assets	9,900	11,200
Interest expense	300	500	Current liabilities	2,000	5,000
Nonoperating expenses	250	300	Noncurrent liabilities	3,000	3,500
	1,450	1,000	Total debt	5,000	8,500
Income tax	305	210			
Net income	1,145	790	Shareholders' equity	4,900	2,700

Free Cash Flow (In $ thousands)	Company B	Company C
Free cash flow	1,200	500

(d) Recommend an LBO candidate to the firm.

ANSWER:

(e) Identify four benefits of LBOs to both corporate management and investors.

ANSWER:

(f) Compare two private equity strategies: venture capital and leveraged buyouts.

ANSWER:

18. QFI PM Fall 2023, Question 1

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18

You are an investment actuary at insurance company ABC. Your team is considering venture capital (VC) investments.

(a) Explain why venture capitalists are not passive investors.

ANSWER:

Your company has committed $50 million to a venture fund. The fund has a management fee of 2% and an incentive fee of 20%. During the first year of the investment, the venture capitalist invested $30 million in a start-up company which generated profits of $6 million.

(b) Calculate the total compensation the venture capitalist will receive at the end of the first year.

ANSWER:

After the first year, the venture capitalist considers two investment options, both requiring a $50 million investment:

Option 1 generates a 5% profit with 90% probability and a 5% loss with 10% probability
Option 2 generates a 50% profit with 20% probability and a 20% loss with 80% probability

(c)

(i) Assess which option is more likely to be chosen by the venture capitalist.

ANSWER:

(ii) Assess whether the venture capitalist's selection benefits ABC or is optimal for ABC.

ANSWER:

(d) Recommend covenants that ABC should include in the venture capital partnership agreements given the answer to part (c).

ANSWER:

19. QFI PM Fall 2023, Question 2

Learning Outcome(s): 1b

Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute

You work at a global investment company and you are analyzing a short-selling hedge fund. An existing client invested in this short-selling fund as well as a traditional market index fund in the years 20XX and 20YY, respectively. Coincidentally, the client achieved the same return in both years.

You are given the following:

Year of Investment	Amount Invested in the Market	Amount Invested in the Short-selling	Risk-free Interest Rate	Market Return

	Index Fund ($m)	Hedge Fund ($m)		
20XX	$3	$5	3.2%	8%
20YY	$8	$12	4.0%	10%

You ignore any idiosyncratic risk associated with the returns of the fund in 20XX and 20YY. The market index fund has a beta of 1 and you assume the beta of the short-selling hedge fund is constant over time.

(a) Calculate the beta of the short-selling hedge fund,.

ANSWER:

Three investors are interested in investing in hedge funds.

Investor A:

- Believes there is currently a bull market
- Wants to minimize idiosyncratic risk
- Wants to minimize event risk
- Is comfortable with the use of leverage but not interested in seeking arbitrage opportunities for specific securities
- Wants international exposure but doesn't want to pay high fees

Investor B:

- Believes the current market is neither in a bull or bear state
- Has a strong view on the direction of one sector of the stock market due to his extensive research
- Also has a directional view on a few individual, healthy stocks within this sector
- Is not seeking exposure internationally

Investor C:

- Believes there is currently a bear market
- Wants to minimize credit risk
- Is comfortable with alpha risk but not beta risk
- Wants to rely on returns from fund manager skill

- Is not supportive of regression analysis

(b) Recommend the most suitable hedge fund strategy for each investor.

ANSWER:

20. QFI PM Fall 2023, Question 3

Learning Outcome(s): 1b, 2k

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021: Ch 19: Portfolio Performance Evaluation

You are the chief investment officer for a defined-benefit pension plan. ~~Recently, the plan's Board members asked you to help them understand the three *super* asset classes below.~~

- ~~Capital assets~~
- ~~Assets that can be used as economic inputs~~
- ~~Assets that are a store of value~~

~~(a) Define each of the above *super* asset classes, including an asset example for each class in your answer.~~

~~ANSWER:~~

(b) Explain the sources of risk premium that allow venture capital investors to earn returns in excess of public market investors.

ANSWER:

(c) Describe the common legal structures of typical U.S. private equity funds and their implications for defined benefit pension plan investments.

ANSWER:

You are looking at the following allocations for your plan's assets. The primary considerations of the asset portfolio are:

- Generate an expected return of at least 4.5%
- Minimize exposure to equity risk

	Portfolio A		**Portfolio B**	
	Allocation	Expected Return	Allocation	Expected Return
Government Bonds	20%	3.5%	20%	3.5%
Corporate Bonds (Investment Grade)	80%	5.0%	60%	5.0%
Distressed Debt			20%	7.0%
Sharpe Ratio	0.7		0.9	

(d) Recommend which portfolio to use.

ANSWER:

21. QFI PM Fall 2023, Question 4

Learning Outcome(s): 1b

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 14

You are the chief investment officer for a pension fund in Country A, where the pension plan is tax-exempt. You are considering commercial real estate for the pension fund investment portfolio.

Your team has prepared the following information for you on property:

- The property is available for sale for $10,810,532.
- The property's expected pre-tax annual Net Operating Income (NOI) is given below. All NOIs are assumed to occur at the end of the year. The cash flow projection is illustrated below:

Year	1	2	3	4	5	6	7	8	9	10
Pre-tax NOI	700,000	710,500	721,158	731,975	742,954	754,099	765,410	776,891	788,545	800,373

Your team is aware that a marginal investor is also interested in buying the property. Your team makes the following assumptions about both investors, the pension fund and the marginal investor:

- Both investors plan to sell the property at the end of year 10.
- The property's selling price is expected to be $11,000,000 at the end of year 10.
- Both investors will take out a $8,000,000 loan to finance the property purchase under the provisions below:
  - The loan's annual interest rate is 6.75%.
  - The loan's annual interest amount is due at the end of each year, assuming the loan is taken at the beginning of the year (at the time of property purchase).
  - Annual loan principal repayment is $30,000 per year, also due at the end of each year.

Any outstanding loan principal is to be repaid when the property is sold.

Additional information is given below based on country A's tax law which the marginal investor is subject to:

- The interest payment on a property loan is tax deductible.
- The tax rate is 25% for all income and capital gains, where the capital gain tax is paid on the difference between the sales price and the purchase price.
- The property's land value, currently estimated to be $3,000,000, is not depreciable.
- The marginal investor has the option to claim the depreciation expenses of the property's structure value for income tax filing.
- If annual depreciation expense is claimed:
  - The straight-line depreciation method over 50 years must be used.
  - The sum of claimed depreciation expenses is subject to a 35% tax at the time of the property sale (known as the recapture tax).

To prepare a competitive bid, your team at the pension fund considers two scenarios to analyze the potential purchase by the marginal investor:

a. The marginal investor claims annual depreciation expenses.
b. The marginal investor does not claim annual depreciation expenses.

(a) Calculate total tax payment in each of the next 10 years for the marginal investor under the two scenarios.

ANSWER IN EXCEL

(b) Calculate the after-tax IRR for the marginal investor under the two scenarios.

ANSWER IN EXCEL

(c) Calculate the maximum price the pension fund should be willing to pay for this property considering the marginal investor's IRR.

ANSWER IN EXCEL

22. QFI PM Fall 2023, Question 11

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 23

You are an actuary working for XYZ Bank which specializes in providing commercial real estate mortgages in the U.S.

(a) Identify the differences in characteristics between commercial and residential real estate mortgage (excluding the property type).

ANSWER:

In an effort to attract more investors, XYZ Bank securitizes their commercial real estate mortgages into a Commercial Mortgage-Backed Security (CMBS) with a simplified structure of three tranches:

- Tranche A is the senior tranche with 20% credit support
- Tranche B is the subordinate tranche
- Tranche X is the interest-only tranche

The CMBS consists of 100 individual commercial mortgages of a loan value of $5M each. Based on historical experiences, these individual commercial mortgages have a default rate of 1% over the lifetime of the loan. They are assumed to be independent from each other. Once defaulted, XYZ Bank expects to recover only 50% of the loan value.

(b) Describe the credit quality of Tranches A and B relative to the underlying mortgages.

ANSWER:

In the past year, interest rates in the U.S. increased rapidly from near zero to near 5%.

(c) Describe the risk factors to the investors in XYZ's CMBS under the current economic environment.

ANSWER:

(d) Recommend changes in future CMBS issues to mitigate the risks.

ANSWER:

23. QFI PM Fall 2023, Question 12

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 22; INV101-102-25: High-Yield Bond Primer

A pension fund, currently invested in traditional bonds is looking to improve the investment returns using high-yield bonds or as debt holders of a Collateralized Loan Obligation (CLO). These investments have increased in popularity on the buy-side because institutional investors are seeking higher yields.

(a) Describe two additional reasons for this increase in popularity.

ANSWER:

(b) Describe the cash flow structures of the following instruments and how they impact the issuer and the pension plan:

~~(i) Deferred interest bonds~~

~~ANSWER:~~

~~(ii) Step-up bonds~~

~~ANSWER:~~

~~(iii) Payment-in-kind bonds~~

~~ANSWER:~~

(iv) CLOs

ANSWER:

As an investor considering that high-yield bonds may provide higher yield, the financial risk profile of the company is an important determinant.

The risk manager mentions that an investment into senior debt of a CLO with the same yield as that of a high-yield bond appears more attractive, when considering diversification, risk appetite and liquidity in the case of default.

(c) Justify the risk manager's statement.

ANSWER:

A member of the board states that CLOs have a high risk of bankruptcy.

(d) Critique this statement.

ANSWER:

24. QFI PM Spring 2024, Question 3

Learning Outcome(s): 1b

Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute

You manage a team of actuarial students, who are analyzing risks and returns of hedge funds.

Your students ~~made the following comments about the~~identified the following risks faced by hedge funds:

1. Complexity risk
2. Illiquidity risk
3. Event risk
4. ~~Process risk is a type of fundamental risk due to the general lack of transparency associated with it.~~
5. ~~Beta expansion risk occurs when hedge fund managers short the same securities.~~
6. ~~Off-balance sheet risk can be due to short volatility risk, fund manager skill risk, and mapping risk.~~

(a) Explain each risk.

ANSWER:

Based on research work on public companies A and B, your student team proposed a stub trading strategy on companies A and B. Company's A ownership in Company B contributes to 25% of Company's A's consolidated operating income. The relevant information is given below:

	On the date the trading strategy began	On the date the trading strategy ended
Company A's share price	$50	$56
Company B's share price	$40	$44
Based on the student team's research work, the share price of Company A's own operation (i.e., when excluding A's ownership in B)	$42	$45
Neither A nor B pays dividends; Transaction cost = $0; A and B have issued the exact same number of shares.		

(b) Construct this strategy.

ANSWER:

25. QFI PM Spring 2024, Question 4

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 19

You are working for ABC Investment Company, a firm that has historically been a prominent market participant in Leveraged Buyouts (LBO) and providing financing for venture capital deals. ABC Investment Company's senior management team is considering exiting the venture capital market due to concerns it is riskier than LBOs.

(a) Explain why LBOs are generally less risky than providing financing for venture capital deals.

ANSWER:

Two publicly traded companies, GHI and LMN, stated that they are openly pursuing offers for the sale of their companies. You are given the following information:

Information / Metric	**GHI**	**LMN**
Years in Business	1	75
Industry	Electric Vehicle Maker	Grocery
1 Year Change in Stock Price	+15%	-50%
Price-to-Book Value Ratio	5.0	0.5
Net Margin	-1%	8%
1 Year Percent Change in Number of Employees	+5%	+20%
Debt-to-Equity Ratio	2.0	0.2

(b) Assess whether ABC should pursue a LBO for each company.

ANSWER:

ABC just closed on the LBO of another company, TUV, for a purchase price of $500 million, of which $300 million is financed with five-year debt. ABC plans to sell TUV immediately after paying off the debt in five years and targets a 30% annual compound return on its initial equity investment over the five-year investment period.

(c) Calculate the minimum amount from a sale of TUV that ABC needs to receive at the end of the investment period in order to meet its annual compound return target.

ANSWER:

(d) Describe the risks with this transaction that may cause ABC not to achieve the annual compound return target.

ANSWER:

26. QFI PM Spring 2024, Question 5

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 23

You have been hired as a real estate subject-matter expert for a large financial institution that is exploring different investments to add to their general account portfolio.

(a) Compare and contrast residential mortgages and commercial mortgages on the basis of:

(i) volume in the market

(ii) loan size

(iii) income generation of the underlying property

(iv) characteristics of the borrower

ANSWER:

As part of your new role, you have been asked to work on a project assessing a Commercial Mortgage-Backed Security (CMBS).

The CMBS structure is as follows:

- There are 100 loans backing the CMBS
- Each loan has an outstanding loan balance of $0.5 million and a coupon (contract) interest rate of 10%
- Tranche A is a Senior (Investment-Grade) class which occupies 75% of the total par value of the underlying loan pool paying an 8% annual coupon
- Tranche B is a Junior (Non-Investment-Grade) class occupying the remaining 25% of the underlying loan pool's par value paying a 16% annual coupon
- Half of the loans mature at the end of 5 years, with the other half maturing at the end of 10 years
- The loans are all non-recourse, with lockouts preventing prepayments

Your co-worker makes the statement, "Tranche B is very attractive given that the risk is not all that different from Tranche A".

(b) Critique the statement.

ANSWER:

Now suppose that the lockout provision has been eliminated from each of the underlying loans, meaning that each borrower is permitted to make a prepayment. You are told that the following prepayments have just occurred today:

- 25 of the loans maturing at the end of 10 years have repaid the entirety of their outstanding loan balance

- 25 of the loans maturing at the end of 5 years have repaid half of their outstanding loan balance

(c) Calculate the amount outstanding in Tranche A and Tranche B after the prepayments.

ANSWER:

Your company's Chief Financial Officer (CFO) is considering investing in Tranche B due to its attractive potential returns. However, you are worried about the underlying credit risk of such an investment.

(d) Recommend a strategy that balances your CFO's desire to increase shareholder returns with your concern of downside risk.

ANSWER:

27. QFI PM Fall 2024, Question 2

Learning Outcome(s): 1a

Source Materials: INV101-101-25: Overview of Investing in Private Corporate Debt; INV101-102-25: High-Yield Bond Primer

You are asked to review a portfolio that is currently backing a block of fixed deferred annuities. The portfolio consists of government and corporate bonds. Senior management is interested in adding alternative fixed income assets, such as private debt funds or high yield bonds, to the portfolio to improve the overall returns.

(a) Compare in terms of return, risk, market, and cash flow characteristics each of the following as they relate to investment grade bonds.

(i) Private debt funds

ANSWER:

(ii) High yield bonds

ANSWER:

Senior management is focused on asset transparency and liquidity.

(b) Recommend which of these two assets to add to the portfolio.

ANSWER:

~~An analyst on the asset management team suggests selling credit default swaps (CDS) with reference to high yield bonds instead of investing in high yield bonds directly. This would limit the cash outflow and eliminate interest rate risk.~~

~~(c) Critique the analyst's suggestion.~~

~~ANSWER:~~

28. QFI PM Fall 2024, Question 13

Learning Outcome(s): 1b

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12

You are an actuary working for the XYZ insurance company. The company is analyzing its current investment portfolio in terms of valuation metrics and asset classes.

(a) Describe two characteristics that differentiate the real estate market from the typical securities investment environment.

ANSWER:

Company XYZ is interested in extending their investment to the real estate market for the first time.

Analyst A highly recommends direct investment in properties because:

- the company can take advantage of the predictability to buy low and sell high with extensive research and
- there are greater opportunities for making successful market timing decisions.

(b) Evaluate analyst A's comments.

ANSWER:

Analyst B recommends REITs, based on favorable NAVs, share prices, and cost of capital projections.

(c) Contrast the quantification of REIT NAVs and REIT share prices.

ANSWER:

You are given the total return performance history in the stock market for two REIT companies:

- REIT Company C has an average cost of capital of 6% and a price/earnings multiple of 10
- REIT Company D has an average cost of capital of 8% and a price/earnings multiple of 12

(d) Assess whether REIT Company C can afford to pay a higher price for a given property than REIT D based on the above two metrics.

ANSWER:

29. QFI PM Fall 2024, Question 14

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 23

You are an investment actuary working for ABC Insurance Co. ABC primarily writes Universal Life and Long-Term Care products, although has recently begun offering Term products on a limited basis.

Your boss has scheduled a meeting to discuss ABC's investment portfolio, which is currently 50% municipal bonds, 40% investment-grade corporate bonds, and 10% cash. One of your co-workers suggests that mortgages be introduced to the investment portfolio.

(a) Identify four differences between residential and commercial mortgages.

ANSWER:

Your boss is particularly interested in adding commercial mortgage-backed securities (CMBS) to ABC's investment portfolio.

(b) Describe key players in the CMBS securitization process.

ANSWER:

Following some discussion, your team has settled on the following Tranches to potentially invest in:

Tranche A: Senior/ Investment Grade, $125M, 7.5% Coupon

Tranche B: Junior/Non-Investment Grade, $50M, 12% Coupon
IO Strip: Notional Par $100M, 3% Coupon

(c) Critique the appropriateness of each of the above tranches that ABC Insurance Co. is considering adding to its investment portfolio.

ANSWER:

(d) Describe moral hazard and adverse selection and how they create challenges for the CMBS industry.

ANSWER:

30. QFI PM Fall 2021, Question 14

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 11

ABC life insurance is considering applying for a syndicated leveraged loan.

(parts a, b and c are no longer covered by the syllabus)

(d) Describe three purposes that common covenants in a leveraged loan obligation serve.

ANSWER:

INV 101
LEARNING OBJECTIVE 2

CATEGORIZED PAST EXAM QUESTIONS

These questions are representative of those which may be asked of candidates sitting for the INV 101 Portfolio Management assessment. These questions are intended to represent the depth of understanding required of candidates. Illustrative Solutions are provided separately.

The questions from this study note are taken from past SOA examinations. Most of these questions are taken from the previous QFI PM examinations. Sub-parts of a question were removed or struck-through if the reference material no longer appears on the current Syllabus.

Table of Contents

1. QFI PM Fall 2020, Question 5

Learning Outcome(s): 2l, 2h

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch7, Ch 13

You are a retail investor working with a financial advisor who actively manages your retirement portfolio. The price of one of your equity holdings, AAA, has dropped to $18 since your financial advisor purchased it at $20 a week ago. You searched for news on AAA but found nothing notable. Getting worried, you discussed this with your advisor and he recommended:

"I wouldn't sell now to realize the losses. AAA has never dropped more than 20% over three months. I analyzed their business model extensively when I bought their shares for another client's portfolio five years ago. Same business today. It's a fantastic name to keep holding."

(a) Describe three behavioral biases your advisor may be displaying.

ANSWER:

~~(b) Explain how the behavior biases of institutional investors could have contributed to AAA's rapid price change.~~

~~ANSWER:~~

Your retirement portfolio is meant to be globally diversified, but you noticed your advisor has a strong home country bias and invested only in US securities.

	Return
Your Manager	10%
MSCI World Index	8%
MSCI US Index	15%

- The portfolio's total active risk computed with respect to MSCI World Index is 6% annually.
- Your manager's true risk adjusted performance (information ratio) is -1.118.

(c) Calculate your manager's misfit risk.

ANSWER:

2. QFI PM Fall 2020, Question 10

Learning Outcome(s): 2b

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

You are the new investment actuary for two clients. Client A is a wealthy couple who:

- wish to leave a large inheritance to their children and grandchildren,
- practice philanthropy during their lifetimes
- seek out the maximum return in all situations.

Client B is a life insurance company operating in the U.S. Neither client currently has an Investment Policy Statement (IPS) in place.

(a) Outline the scope and purpose of an IPS.

ANSWER:

(b) Compare and contrast IPS investment objectives between the two clients.

ANSWER:

(c) Explain governance considerations to be included in the insurance company IPS.

ANSWER:

(d) Compare and contrast investment constraints between the two clients.

ANSWER:

3. QFI PM Fall 2020, Question 11

Learning Outcome(s): 2i, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You are an investment analyst at a large pension fund. To gauge investment performance, the fund sponsor proposed a benchmark to be in the top quartile of its peer group over the previous calendar year.

(a) Evaluate the properties of the proposed benchmark in comparison to an ideal benchmark.

ANSWER:

Your colleague recommended an equity portfolio manager, XYZ Investment Management, who runs a U.S. large-cap value portfolio which returned 23.5% during the first three quarters of 2019. You have been provided the following information for the same time period:

Index	Return
Russell 1000 Value Index	21.7%
Russell 2000 Index	27.5%
Russell 3000 Index	25.2%

(b) Calculate XYZ Investment Management's return due to both style and active management.

ANSWER:

(c) Interpret your results for both style and active management.

ANSWER:

The plan sponsor is trying to decide between two equity portfolio managers, ABC Equities and DEF Equities, for the same mandate. ABC will produce on average annual value-added return of 1.5% over the benchmark, with variability of the excess returns of 2.24%. DEF is expected to produce a higher annual value-added return of 4%, but with variability of excess returns around 10%. The table below shows the probability of a manager outperforming a benchmark given various levels of investment skills.

Information Ratio

Years	*0.20*	*0.30*	*0.40*	*0.67*	*0.80*	*1.00*
1.0	58.39	62.97	66.46	75.57	79.18	85.39
5.0	68.62	75.65	82.55	94.02	96.87	98.37
10.0	74.56	83.68	90.07	98.52	99.35	99.89
20.0	82.07	92.12	97.23	99.68	99.98	99.99

(d) Determine which manager has the lower chance of outperforming the benchmark.

ANSWER:

Your colleague recommends DEF Equities over ABC Equities, based only on ABC's lower annual value-added return when compared to DEF.

(e) Explain the shortcomings of your colleague's recommendation.

ANSWER:

4. QFI PM Fall 2020, Question 15

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You are reviewing the performance of the investment team in the company with three portfolio managers managing a $700 million portfolio. You are given the following summary information:

	Manager A	Manager B	Manager C	Benchmark
Assets under management ($ million)	200	100	400	
Number of stocks	30	20	95	100
Dividend yield	3%	5%	4%	4%
P/E ratio	7.1	3.0	4.9	5.0
P/B ratio	4.1	2.5	3.1	3.0
EPS growth (5-year projected)	17%	11%	15%	15%
Active return	2%	3%	0%	
Tracking risk	4%	5%	0%	

(a) Evaluate the performance of each individual manager and overall portfolio based on the trade-off between active return and tracking risk.

ANSWER:

(b) Evaluate the investment style and strategy of Manager B.

ANSWER:

(c) ~~Describe the structure of the overall portfolio.~~

~~ANSWER:~~

You wonder if the benchmark is a good indicator for the performance measurement and would like to find out more using either returns-based or holdings-based style analyses.

(d) Compare and contrast these two analyses.

ANSWER:

5. QFI PM Spring 2021, Question 1

Learning Outcome(s): 2g, 2h, 2j

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 12, Ch 13, Ch 19

You recently started up your own equity investment firm and have several meetings scheduled with prospective clients. As part of your marketing efforts, you are coming up with educational material to explain different investment styles.

(a) Define passive, active, and semi-active equity investing.

ANSWER:

Your firm aims to create a new equity index consisting of a portfolio of 3 stocks whose current information is shown below.

Ticker	Price ($)	Market Value ($ Millions)	Free Float Factor
ABC	84	25,000	1

PQR	42	40,000	0.50
XYZ	35	36,000	0.75

(b) Calculate the weighting of XYZ under each of the following index weighting methods:

i) Price-weighted

ANSWER:

ii) Equal-weighted

ANSWER:

iii) Float-weighted

ANSWER:

A prospective client is looking for a manager to track the Russell 2000, a float-weighted small-cap index, because their existing manager significantly underperformed the index. They explained that their existing manager used a full replication approach and that there were several periods of inflows and outflows to the fund last year.

(c) Explain why the existing manager may have underperformed the index.

ANSWER:

Your final meeting is a consultation with a client who is evaluating two active investment choices. One is a long-only portfolio benchmarked to the LMN 50, an index of the 50 largest domestic stocks. The other is a long-short portfolio using domestic stocks with an overlay of LMN 50 futures. The LMN 50 index performance is dominated by a few of the largest stocks.

(d) Describe how equitized long-short portfolios are typically structured.

ANSWER:

(e) Explain why the long-short strategy may be more appropriate than the long-only strategy.

ANSWER:

6. QFI PM Spring 2021, Question 2

Learning Outcome(s): 2f, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10, Ch 19

You have recently joined XYZ Asset Management as a fixed income analyst to help support several portfolios. Each portfolio is managed to a well-defined benchmark. In addition, you help manage assets for several pension plans.

Your first task relates to the Long Corp Portfolio, which is mandated to track very closely a long duration, investment grade corporate bond index. Based on recent experience, you notice that the Long Corp Portfolio is consistently lagging behind the benchmark. Upon discussion with the fund manager, you learn that the Long Corp Portfolio is currently utilizing a full replication approach.

(a)

(i) Describe one advantage and one disadvantage of the full replication approach investment strategy.

ANSWER:

(ii) Describe an alternative fixed income investment strategy for the Long Corp Portfolio which could improve performance.

ANSWER:

Your next task relates to two additional portfolios – the Investment Grade Corp Portfolio and the Growth Portfolio. You have been given historical returns for both portfolios, as well as their respective indices.

	Year 1	Year 2	Year 3	Year 4
Investment Grade Corp Portfolio	5.0%	2.5%	4.0%	3.5%
Investment Grade Corp Index	4.5%	3.0%	4.0%	4.0%
Growth Portfolio	8.0%	-2.0%	10.0%	6.0%
Growth Fund Index	6.0%	4.0%	5.0%	3.0%

(b) Calculate the average active return and tracking risk for each of the portfolios.

ANSWER:

Your colleague is looking at ways to improve Investment Grade Corp Portfolio performance. Based on current market trends, they believe that interest rates are set to decline significantly at longer durations. As a result, your colleague wants to use leverage so that they can increase the fund's exposure to long duration assets. Your colleague plans on buying interest rate futures to capitalize on their forecasts.

(c) Critique your colleague's strategy.

ANSWER:

Your pension client sends you projected liability cash flows from which you are expected to develop and implement asset strategies for a defined benefit plan. The client is very sensitive to interest rate risk and wishes to control their investment expenses. The plan is frozen and very mature with the majority of members having already retired. It is well funded.

(d) Recommend an investment strategy to employ for this client.

ANSWER:

7. QFI PM Fall 2020, Question 10

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

For the year 2019, the quarterly performance of a pension portfolio manager is shown below: The values were calculated on a money-weighted rate-of-return basis.

Quarter 1	5.3%
Quarter 2	-3.2%
Quarter 3	4.5%
Quarter 4	1.2%

Since the pension portfolio manager has no control over the size and timing of external cash flows into or out of his accounts, he believes that time-weighted rate of return is a more appropriate measure of account performance.

(a) Explain how you would approximate a time-weighted rate of return for the entire year of 2019.

ANSWER:

(b) Discuss the limitation of approximating a time-weighted rate of return calculation this way.

ANSWER:

(c) Determine the approximate time-weighted rate of return.

ANSWER:

The table below shows the results of a micro attribution analysis on an investment manager.

Economic Sectors	Portfolio Weight (%)	Sector Benchmark Weight (%)	Portfolio Return (%)	Sector Benchmark Return (%)
Basic materials	6.79	6.45	-0.97	-0.76
Capital goods	8.28	8.87	-3.06	-3.59
Consumer durables	3.09	3.83	0.64	-0.12
Consumer nondurables	30.87	33.57	1.94	1.99
Energy	6.51	5.10	0.35	0.16
Financial	22.74	20.19	2.95	2.07
Technology	12.41	16.20	2.05	-0.25
Utilities	7.46	5.79	0.42	-0.36
Cash and equivalent	1.85	0.00	0.12	
Buy/Hold + Cash	100.00	100.00	1.28	0.66
Trading and Other			-0.15	
Total Portfolio			1.13	0.66

(d) Determine how the investment manager performed on the Technology sector based on performance attribution analysis.

ANSWER:

Below are the results of a micro attribution analysis using fundamental factor model.

Market return	6.09%
Normal portfolio return	5.85%
Total market timing return	5.76%
Total Fundamental Risk Factor return	5.24%
Total Economic Sector return	6.00%
Actual Portfolio return	6.05%

(e)

(i) Calculate the specific or unexplained return component.

ANSWER:

(ii) Interpret the attribution.

ANSWER:

8. QFI PM Fall 2020, Question 16

Learning Outcome(s): 2d, 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 10

ABC Life's liability portfolio consists of traditional life products, universal life with secondary guarantees, and variable annuities with guaranteed riders.

(a)

(i) Identify the common strategies under the two dimensions of ALM practice.

ANSWER:

(ii) Determine which ALM strategies are the more appropriate for ABC Life.

ANSWER:

ABC Life's investment policy statement (IPS) requires an annual net real return of 5% on its investments. The average annual inflation rate is 2% and the annual investment cost is 1%.

(b) Calculate the minimum gross return requirement under ABC Life's IPS.

ANSWER:

ABC Life's IPS only permits investments in four asset classes: equities, bonds, mortgages, and real estate. The historical data for these four asset classes are given in Table 1 below.

Table 1

Asset Class	Mean Return	Standard Deviation	Correlation (Asset Class)			
			Equity	Bond	Mortgage	Real Estate
Equity	15%	32%	1	-0.72	0.45	0.74
Bond	5%	10%		1	-0.23	-0.86
Mortgage	10%	12%			1	0.23
Real Estate	12%	28%				1

With the above data, your analyst used the Mean-Variance Approach to calculate five corner portfolios (as shown in Table 2 below) to construct the efficient frontier for portfolio optimization. No short-selling is allowed. The current risk-free rate is 3%.

Table 2

Corner Portfolio	Mean Return	Standard Deviation	Sharpe Ratio	Portfolio Weight (Asset Class)			
				Equity	Bond	Mortgage	Real Estate
1	15%	32%		100%	0%	0%	0%

	2	13%	A	B	60%	0	40%	0
	3	11%	13%	61.5%	20%	2%	72%	6%
	4	C	7%	85.7%	11%	36%	40%	13%
	5	7%	3.6%	111.1 %	2%	70%	8%	20%

(c) Calculate A, B, and C in Table 2.

ANSWER:

(d) Calculate using the Corner Portfolio Theorem the respective weight for equity and for bond in the efficient portfolio that will meet ABC Life's investment objective.

ANSWER:

ABC Life is considering two alternative approaches for portfolio optimization:

(i) Black-Litterman Approach

(ii) Experience-Based Approach

(e) Critique the above alternative approaches for portfolio optimization.

ANSWER:

9. QFI PM Fall 2021, Question 1

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You have recently been hired by an investment management firm to help evaluate the performance of several portfolios. Your first set of tasks relate to the use of benchmarks for existing investment portfolios.

(a) List four criteria for establishing a good benchmark.

ANSWER:

While reviewing a portfolio's performance, a colleague questions if the benchmarks currently being used to evaluate fund performance are appropriate and asks for your opinion.

(b) Describe three heuristic tests that can be performed to assess the quality of a benchmark.

ANSWER:

You are now asked to review the calculation of portfolio returns. You are told that for Portfolio X, the portfolio receives cash contributions/withdrawals on a quarterly basis; however the amount of cash flows are difficult to predict.

(c) Assess the appropriateness of calculating returns using each of the methods listed below:

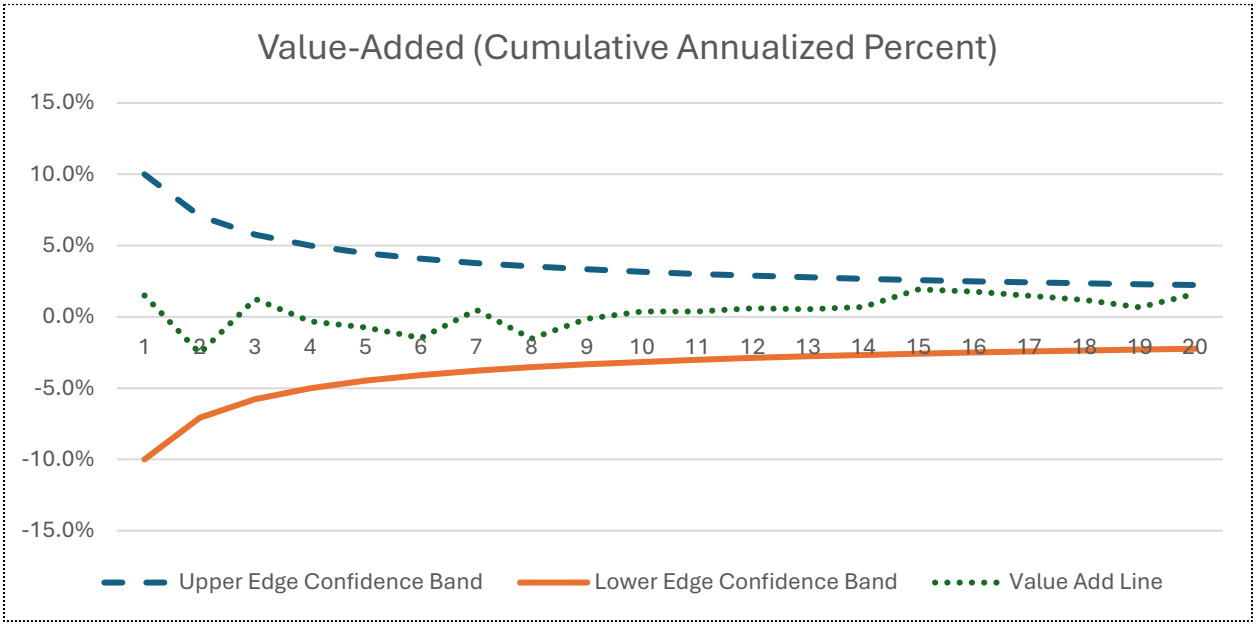
i) Time-weighted rate of return

ANSWER:

ii) Dollar-weighted rate of return

ANSWER:

A colleague is analyzing the following quality control chart for Portfolio Y, which is calibrated at the 80th percentile.



Your colleague claims that, based upon the above chart, the portfolio manager is truly skillful as they were able to outperform the benchmark by 1.6% per year over a 20 year period.

~~(d) Critique your colleague's statement.~~

~~ANSWER:~~

10. QFI PM Fall 2021, Question 2

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10

A US based insurance company XYZ is considering an investment in a USD-denominated global sovereign bond fund with an absolute return target. The portfolio manager for the fund provides the following composition for the portfolio:

Bond	Currency	Maturity (years)	Yield to Maturity (AEY)	Country Beta	Annual Coupon	Duration	Par Amount	Price
A	USD	5	0.85%	1.00	3.00%	4.71	3,000,000.00	110.47%
B	EUR	4	-0.34%	0.42	0.20%	3.99	3,000,000.00	102.18%
C	CAD	3	0.89%	0.47	2.25%	2.92	4,000,000.00	104.00%

The current spot currency rates are quoted as EURUSD = 1.2161 (1.2161 USD per EUR) and USDCAD = 1.2120 (1.2120 CAD per USD). Assume that at any point in time the yield curve is flat, yields are in annual equivalents, and the bonds have no credit risk. The bonds pay annual coupons with the first coupon due one year from today.

(a) Calculate the US dollar duration of the portfolio.

ANSWER:

You ask the portfolio manager about his outlook on the economy. He provides the following projections for 1 year into the future.

Bond	Local Yield Curve Shift	Duration

A	+0.15%	3.82
B	+0.07%	3.00
C	+0.08%	1.97

The portfolio manager also expects EURUSD to be at 1.10 and USDCAD at 1.30 in one year.

Each country's beta is also assumed to remain unchanged at the end of the year.

At that time, he would like to maintain the US dollar duration of the portfolio equal to today's.

(b) Calculate the rebalancing ratio for the portfolio given the stated goals.

ANSWER:

~~The manager says that he plans on hedging all currency exposure over the 1-year horizon and has determined that the hedged return will be 1.00% for Bond A, -0.27% for Bond B, and 0.97% for Bond C~~

~~(c) Critique the portfolio manager's plan on hedging all currency exposures assuming Interest Rate Parity holds.~~

~~ANSWER:~~

11. QFI PM Fall 2021, Question 8

Learning Outcome(s): 2h, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 13, Ch 19

You manage an equity portfolio for a large pension fund. You have three portfolio managers working for you, who have the following characteristics:

	AUM (millions)	Expected Alpha (%)	Expected Tracking Risk (%)
Manager A	500	2	2
Manager B	300	2	3
Manager C	200	4	5

The pension fund's trustees have stated objectives of achieving an information ratio of 1 or greater, with tracking risk of no more than 2% annually.

Assume the managers' expected alphas are uncorrelated.

(a) Assess if the current portfolio of managers is expected to meet the investment objectives.

ANSWER:

You realized that the benchmark used to measure managers' performance is outdated. This old benchmark has an expected annual return of 4%, and the managers' misfit risk is 1% annually. The revised benchmark for the three manager's investment universe has an expected return of 5% and the managers' misfit risk is 1% annually.

(b) Assess if the current portfolio of managers is expected to meet the investment objectives, based on the revised benchmark and managers' true active return and active risks.

ANSWER:

To formulate expectations about the three managers' future performance, you would like to utilize the returns-based style analysis and the holding-based style analysis to assess each portfolio manager's investment style.

(c) Compare and contrast these two types of techniques for identifying investment styles.

ANSWER:

You have conducted a holding-based style analysis on Manager B's portfolio and obtained the following result:

	Manager B's Portfolio	Investment Universe Benchmark Index
P/E	20.5	20
P/B	4.1	4
Dividend yield	1.4%	1.5%

(d) Analyze Manager B's investment style.

ANSWER:

~~Manager C is considering incorporating ESG criteria in his investment decisions.~~

(e) ~~Describe four benefits of incorporating ESG criteria in portfolio management.~~

~~ANSWER:~~

12. QFI PM Fall 2021, Question 12

Learning Outcome(s): 2d

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6

You are an investment consultant who manages portfolios for high net worth individuals. Your manager is currently reviewing a client's portfolio with the client and has asked for your help.

You've reviewed the client's Investment Policy Statement (IPS) and note the following about the client:

- The client is a mean-variance theorist
- The client is currently invested in his global minimum-variance portfolio (MVP)
- The client is concerned about his current level of risk and wants to reduce it
- The client is wants to maximize expected return given his risk tolerance

(a) Define the following:

(i) Efficient Portfolio

ANSWER:

(ii) Global Minimum Variance Portfolio

ANSWER:

(iii) Tangency Portfolio

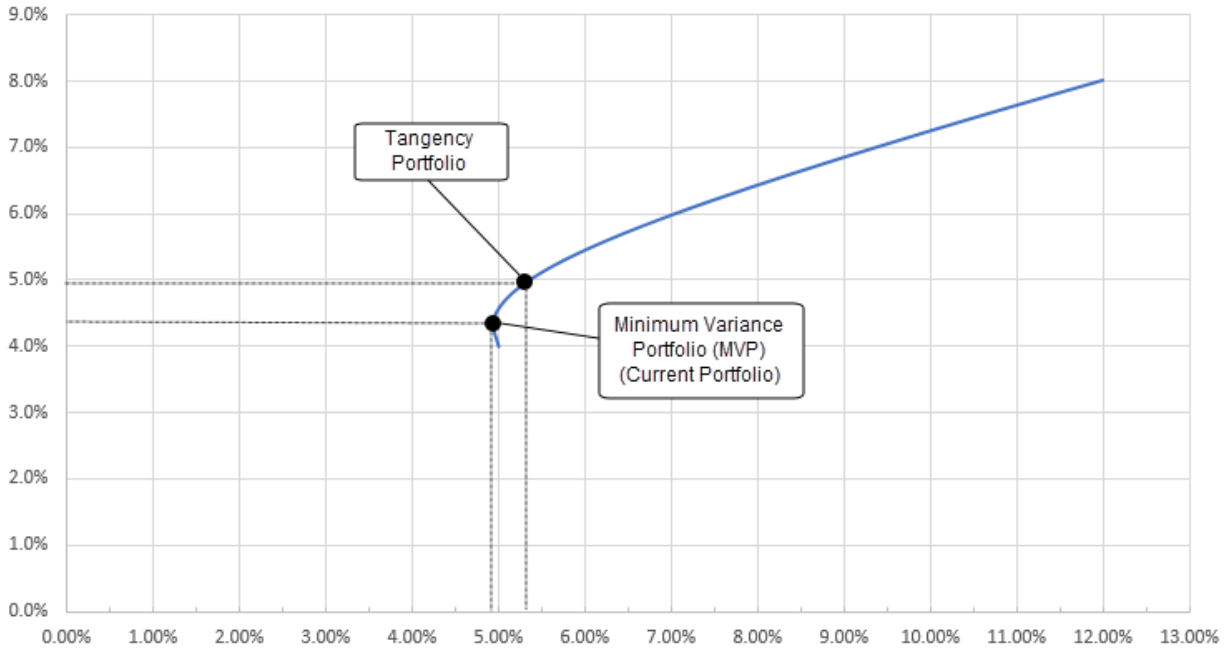
ANSWER:

~~(iv) Capital Allocation Line~~

~~ANSWER:~~

Details surrounding the client and relevant assumptions are shown below:

The client's efficient frontier:



Market assumptions and the client's portfolio mix:

Asset Returns	Expected Return	Standard Deviation
Bond Portfolio	4.00%	5.00%
Equity Portfolio	8.00%	12.00%
Risk-free	1.00%	0.00%

Correlation between Bonds and Equities: 25%

Asset Mix	Current Asset Mix
Bond Portfolio	92.8%
Equity Portfolio	7.2%

Portfolio	Expected Return	Standard Deviation

Global Minimum Variance Portfolio (Current Portfolio)	4.29%	X
Tangency Portfolio	4.94%	5.29%

(b) Calculate the standard deviation of the client's current portfolio. (Solve for X)

ANSWER:

During the review meeting with your manager and the client, your manager states:

> "We need to reduce risk yet still maintain an efficient portfolio yielding the same return. This can be done by reducing the portfolio's standard deviation though investing in the risk-free asset is not an alternative to be considered. We should sell all the equity in the portfolio and replace it with bonds since bonds have a lower standard deviation than equity. Through this, we can reach our client's goal of maximizing return and minimizing risk in our portfolio design. "

(c)

(i) Explain why your manager is incorrect.

ANSWER:

(ii) Assess possible impacts to your client's portfolio if your manager's recommendation is followed. (Hint: be sure to compare to your client's IPS notes and comment on the change in standard deviation and expected return.)

ANSWER:

(d)

(i) Describe how to use the capital allocation line to create a portfolio for your client with less risk (smaller standard deviation) but same expected return as his current portfolio (MVP).

ANSWER:

(ii) Calculate the asset mix and standard deviation of the portfolio that has the same expected return as the client's current portfolio but smaller standard deviation.

ANSWER:

13. QFI PM Fall 2021, Question 13

Learning Outcome(s): 2b, 2d

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6

ABC, a public stock P&C insurer, will establish a new pension plan financed only by the plan sponsor in the form of either a defined benefit (DB) or a defined contribution (DC) plan to retain its employees.

(a) Describe four reasons why an Investment policy statement (IPS) is important to ABC's pension plan.

ANSWER:

(b) Describe how each of the following relates to ABC's IPS:

(i) Capital market expectation (CME)

ANSWER:

(ii) Strategic asset allocation (SAA)

ANSWER:

The board suggests to use ABC's IPS for insurance products with minor modifications.

(c) Critique this suggestion.

ANSWER:

(d) Explain how an IPS is used for investment risk management of a DC plan.

ANSWER:

ABC shows solid profitability and surplus. This supports the objective to invest the pension fund in alternative assets, such as private equity, infrastructure, and sponsor-company stock. The average age of the employees is around 35 years old with little employee turnover and no employees close to retirement.

(e) Explain the relevant considerations for ABC to incorporate in the IPS for a DB and DC plan, respectively, for each of the following:

- Risk and return objectives;
- Liquidity;
- Time horizon;
- Investment options.

ANSWER:

14. QFI PM Spring 2022, Question 3

Learning Outcome(s): 2i, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You are an investment actuary at XYZ insurance company responsible for performance and attribution calculations for XYZ's annuity surplus portfolio.

You are provided with the following information regarding XYZ's annuity surplus portfolio:

- On January 1, the market value of the surplus portfolio is $115M.
- On February 1, the reserve strengthened and $10M of cash is transferred from the surplus portfolio to the liability-backing portfolio. The market value of the surplus portfolio is $110M after the cash transfer.
- On April 1, dividends and coupons totaling $5M is paid from investments in the surplus portfolio.
- On May 1, $10M of cash in the surplus portfolio is invested back into fixed income assets already in the portfolio. The total market value of the portfolio after the reinvestment is $120M.

Assuming an equal number of days in each month.

(a) Calculate the time-weighted rate of return of the surplus portfolio from January 1 to May 1.

ANSWER:

You are provided with the following information on the surplus portfolio as of December 31.

Asset Class	Benchmark	Portfolio Weight	Target Weight	Asset Class Performance	Benchmark Performance
Fixed Income	Barclays U.S. Bond Index	50%	45%	7.5%	4.5%
Equity	S&P 500 Index	30%	40%	10.0%	9.0%
Real Estate	MSCI U.S. REIT Index	20%	15%	5.0%	6.0%

(b) (*2 points*)

(i) (*0.5 points*) Calculate the overall portfolio return and overall benchmark return.

ANSWER:

(ii) (*1.5 points*) Calculate the active asset class allocation return and active security selection return, assuming interaction returns are folded within security selection.

ANSWER:

You are also provided with the following information on the liability-backing portfolio as of December 31.

Fixed income returns are attributed into the following factors:

- Carry: return arising from the passage of time
- Interest rates: return arising from changes in interest rates
- Credit spreads: return arising from changes in credit spreads

Sector	Weight		Portfolio Return			Benchmark Return		
	Portfolio	Benchmark	Carry	Interest Rates	Credit Spreads	Carry	Interest Rates	Credit Spreads
Government	15%	30%	1.5%	-1.0%	-	1.0%	-1.2%	-
Corporate	85%	70%	3.0%	-1.5%	2.5%	2.5%	-1.5%	2.7%

The portfolio aims to meet the following objectives:

- The liability-backing portfolio has a focus on book yield and the portfolio yield should exceed that of the benchmark.
- The liability-backing portfolio should be less sensitive to credit spreads than the benchmark.

(c) Assess the performance of the portfolio in meeting its objectives.

ANSWER:

XYZ is also looking to implement a framework for the liability-backing portfolio where the portfolio is not marked-to-market with respect to changes in the yield curve.

Assume that interaction returns are folded into security selection.

(d) Calculate the active sector allocation return and active security selection return under the new framework.

ANSWER:

15. QFI PM Spring 2022, Question 6

Learning Outcome(s): 2k, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19; The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011 Ch 10, Ch 18

You are reviewing the investment portfolio of XYZ life insurance company, whose liabilities consist primarily of defined benefit pension obligations and whole life insurance policies.

~~(a) Describe four ways in which insurers may take excessive risks that could impact investment decisions.~~

~~ANSWER:~~

(b) Describe three measures used to examine the performance of an investment taking its risk into account.

ANSWER:

XYZ is planning to add a position in a new fund to its well-diversified equity portfolio for its pension plan. Two funds are being considered (A) and (B).

	A	B
Risk-free Rate	3%	
Fund Return	10%	12%
Std Dev of Fund Return	5%	7%
Systematic Risk	1.25	1.75

(c)

(i) Calculate the Sharpe ratio and Treynor ratio for each fund.

ANSWER:

(ii) Recommend which fund to invest in based on your results from part (c) i).

ANSWER:

Your assistant has made the following suggestions to mitigate the negative effects of the low interest rate environment:

- We should reposition our portfolio such that 50% is allocated to infrastructure investments to increase returns.
- We should invest in emerging market sovereign debt, which is foreign risk-free debt, due to the high return relative to our Treasury yields.
- We can consider increasing our target allocation in equities to earn a higher return.

(d)

(i) Explain why a prolonged low interest rate environment poses additional risk.

ANSWER:

(ii) Critique your assistant's suggestions.

ANSWER:

16. QFI PM Spring 2022, Question 9

Learning Outcome(s): 2b, 2c, 2d

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6

You are an actuary working for a pension consulting company. Your client, ABC, is a large and mature sugar company. ABC has a long history of operation, with stable income historically. ABC has established a registered defined benefit pension fund for all their employees. All pensions are paid in local currency, which is not US Dollars. You are asked to establish the investment policy statement for the pension fund with the following demographics:

- Half of the workforce are experienced sugar farmers with an average age of 55 years.
- The other half are very young and in good health.
- The average age of all of the plan participants is 39 years old.
- The average liability duration of the plan is 20 years.

Due to the recent shift in dietary recommendations, sugar demand has been dropping globally and the company's income has been slowly declining. The pension fund for ABC is currently funded at 100% with a historical fund return of 6.5%. In ABC's jurisdiction, investment income for registered pension funds is tax-exempt.

(a) List eight typical elements of an investment policy statement.

ANSWER:

(b) Describe the return objectives and liquidity requirements of the ABC pension plan

ANSWER:

In order to try and earn a high return for the pension fund, ABC's retirement policy committee has suggested investing in a new asset class, BitCoin, which has been recently created and is actively traded in US Dollars, to fund the pension liability.

(c) Evaluate whether the proposal fulfills four standard investment constraints.

ANSWER:

17. QFI PM Spring 2022, Question 16

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10

You manage a portfolio of bonds to support a group of liabilities.

- Liabilities in the next three years have payments of $1 million annually at the end of each year.
- The liabilities are supported by 3 bonds that pay coupons at the end of each year that were just purchased.
- All bonds are also readily available for additional purchase at par.

Bonds	Par Value ($ in millions)	Coupon
30 years	10	3.50%
20 years	4	3.25%
3 years	1	1.00%

To support this liability, you are required to use cashflow matching using the principal and coupon payments of the above bonds.

(a) Calculate the unfunded liability position of your matching strategy at the end of each of years 1-3 for the liabilities and the supporting assets.

ANSWER:

Assume excess cash at the end of the period is allowed.

(b) Calculate the minimum value of bonds to purchase to fully cashflow match the liabilities.

ANSWER:

(c) Evaluate if cashflow matching is an appropriate method for these liabilities.

ANSWER:

Other liabilities are backed by bonds in another asset portfolio as shown below.

	PV of Position ($ in Million)	Duration
Assets	550	8
Liabilities	540	12

(d) Calculate the amount of assets above that you will need to purchase to immunize this net asset/liability position.

ANSWER:

Alternatively, interest rate futures can be purchased to immunize the net position from interest rate risk. Bond A is used to settle the futures contract as it is the Cheapest-to-Deliver:

	Duration	Market Value of Bond ($ in millions)	Conversion Factor
Bond A	7	10	1.2

(e) Calculate the number of full future contracts that would be needed to be bought or sold to successfully immunize the net position.

ANSWER:

The portfolio manager would like to decrease the duration of the asset to 6 to support another, shorter, set of liabilities,

(f) Calculate the number of full future contracts that would need to be bought or sold to achieve this.

ANSWER:

18. QFI PM Fall 2022, Question 2

Learning Outcome(s): 2i, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

In evaluating the performance of a fixed-income investment manager, your supervisor suggested that the fixed income total return should consist of the following four components:

- Return from interest rate management
- Return from sector/quality management
- Return from selection of specific securities
- Return from trading activities

(a) Critique your supervisor's assessment.

ANSWER:

To evaluate the manager's value-added return, you compared the portfolio's recent sector weighting and bond selection to a benchmark bond index:

Sector	**Portfolio Weight (%)**	**Index Weight (%)**	**Portfolio Return (%)**	**Index Return (%)**
Government bonds	50.8	54.5	2.4	2.4
Corporate bonds	40.2	39.0	3.5	3.8
Mortgaged backed securities	9.0	6.5	5.5	5.0

(b) Derive a micro attribution analysis by calculating the value-added returns due to sector allocation, within-sector selection, and allocation/selection interaction.

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

Your supervisor asks you to look at a simplified framework for Return Accountability, that is divided into quadrants I, II, III, and IV. You have been provided with the following matrix with quadrants identified which contains mean annualized returns by activity for the investment manager over the last 15 years.

		Selection	
		Actual	Passive
Timing	Actual	(IV)8%	(II) 11.12%
	Passive	(III)11.5%	(I) 12.25%

(c)

(i) Calculate active returns due to timing, security selection, and other items.

ANSWER:

(ii) Calculate how much total active management by the manager investment has benefited or cost the plan over the 15-year period.

ANSWER:

19. QFI PM Fall 2022, Question 3

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Company ABC manages pension funds using a collection of several portfolios.

Below is information about the equity portfolios under three different active managers. Index Y is a broad market index.

Manager	Amount	Return	Total active risk with respect to Index Y	Misfit risk	Manager's orientation
A	200	11%	2%	1%	Market
B	100	14%	3%	2%	Value
C	100	14%	4%	3%	Momentum

In addition to the broad market index, there are two component indices associated with Y.

Index	Return
Y	10%
Y Value	12%
Y Momentum	13%

Manager performance is evaluated based on the information ratio.

Recently, Company ABC has become concerned about the ability of its portfolios to meet future obligations in a shifting economic environment. Specifically, senior management has become concerned about the long-term performance of ABC's traditional equity-centric asset allocation approach as inflation and growth change.

(a) Assess the relative performance of the three managers A, B, and C.

ANSWER:

20. QFI PM Fall 2022, Question 6

Learning Outcome(s): 2e

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9

The Chief Investment Officer of your company has asked you to evaluate a new core-plus fixed-income fund. As you read through the fund's prospectus, you notice that the manager is able to allocate a portion of the fund to emerging markets sovereign debt and that the fund utilizes leverage by use of the repurchase agreements. In the "Risk Factors" section of the document, it lists the repo rate as a potential risk to its return.

(a) Identify two advantages and four disadvantages of investing in emerging market debt.

ANSWER:

(b) Explain three factors that can drive the repo rate to be a drag on the fund's return.

ANSWER:

You examine the performance metrics of the fund, and notice:

- The fund returned 8% over the previous year.
- Estimated return from the underlying bond holdings is 3.5%.
- The fund is leveraged at a borrowing rate of 2%.

You assume the leverage ratio remains constant over the previous year.

(c) Calculate the return on the bond holdings that would have resulted in the complete exhaustion of the fund over the past year.

ANSWER:

Recently, your company sold a Guaranteed Investment Contract (GIC) to a large institutional client. The terms of the transaction are:

- The client pays $100 million premium at the beginning of year 1 (the contract inception date), and $60 million premium at the beginning of year 2.
- The contract matures at the end of year 2 with guaranteed maturity value of $166 million.

The yield curve is flat at 2.40% at the contract inception.

(d) Design an immunization strategy to manage the investment portfolio for this GIC contract.

ANSWER:

21. QFI PM Fall 2022, Question 13

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 19

You are given the task of selecting and monitoring asset managers for an equity portfolio investing in stocks listed on the XYZ stock exchange. You are given six different fund managers to allocate shares of the portfolio to with the following statistics:

Style	mean return	active risk
A: Invest in stocks with low P/E ratios	9%	3%
B: Looks for stocks with high P/E ratios	7%	1%
C: Looks for opportunity among stocks whose price recently went down	10%	5%
D: Buy companies with market capitalization below $50 million	12%	4%
E: Specialized in non-fossil energy	7%	2%
F: Specialized in agrochemical and agricultural companies	10%	2.5%

The active risk measure is calculated based on the XYZ broad market index, whose mean annual return is 8%. Manager B and manager C are 12.5% correlated.

(a) Construct a portfolio with manager B and manager C that has an expected return above 8%, an active risk below 2% and an information ratio above 4.2, you can't "short" a manager.

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

You are also given the following sub-indices that can be used as benchmark for the different managers:

(b) Recommend an appropriate benchmark for each manager.

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

	mean return	standard deviation from XYZ index
1. XYZ mining	9%	2%
2. XYZ commodity	8%	2%
3. XYZ energy	9%	1.5%
4. XYZ small capitalization	12%	3%
5. XYZ value	9%	2%
6. XYZ growth	6%	0.5%

(c) (*1.5 points*) Analyze whether it is worth hiring manager C compared to index investing.

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

~~A colleague suggested that you invest more with manager E and less with manager F. You agreed with her and decided not to invest with manager F and increased your allocation to manager E.~~

~~(d) Justify your decision. (Hint: Explain how manager F may represent more risk than the statistics are telling and how manager E may represent more opportunity.)~~

~~ANSWER:~~

22. QFI PM Fall 2022, Question 17

Learning Outcome(s): 2b

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors

Your company sells variable annuity products with various guarantees and also has a closed block of universal life. Each product is backed by its own asset portfolio.

Recently you were asked to join a meeting with the investment committee.

~~You are presented with the following table of projected current period cash flows for the two products:~~

~~in $millions~~	~~Product A~~	~~Product B~~
~~Liability Cash Flows~~		
~~Premium~~	~~100~~	~~0~~
~~Surrender~~	~~(10)~~	~~(15)~~
~~Benefits Payment~~	~~(5)~~	~~(20)~~
~~Commission~~	~~(20)~~	~~0~~
~~Expense~~	~~(5)~~	~~(4)~~
~~Asset Cash Flows~~		
~~Investment Income~~	~~5~~	~~10~~
~~Principal~~	~~10~~	~~24~~
~~Net Cash Flow~~	~~75~~	~~(5)~~

~~(a)~~

~~(i) Identify each product~~

~~ANSWER:~~

~~(ii) Describe how each product would require portfolio construction differently.~~

~~ANSWER:~~

~~The portfolio backing the legacy block of business contains several bonds with five years remaining until maturity with a book yield of 6%. The current market yield for a 5-year bond is 4%. It is estimated that the liability duration for this block is less than ten years. The portfolio manager thinks we can sell these bonds to harvest a capital gain.~~

~~(b) Critique the proposal.~~

~~ANSWER:~~

During the meeting, management decided to develop an Investment Policy Statement (IPS).

(c) Describe typical constraints in an IPS.

ANSWER:

(d) Describe how an IPS would document governance.

ANSWER:

23. QFI PM Spring 2023, Question 1

Learning Outcome(s): 2e, 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10

ABC company offers an U.S. 401(k) plan to its employees. The company recently added four indexed bond funds, named A, B, C, and D as shown below, to its 401(k) investment options. These four indexed funds are managed by XYZ Associates, an investment management firm.

Fund	Tracking Index	Duration	Investment Grade?

A	Barclay's Corporate High-Yield Bond Index	Medium	Below
B	Barclay's Corporate Intermediate Bond Index	Medium	Yes
C	Merrill Lynch 1 to 3 Year Corporate Bond Index	Short	Yes
D	Merrill Lynch Long-term Corporate Bond Index	Long	Yes

Assume that people are more risk averse the older they become.

(a) Assess which index fund (or funds) from the above table is most suitable for each of the three types of employees: "young", "mid-aged", and "near retirement".

ANSWER:

The tracking error for one of the funds managed by XYZ Associates over the last 10 years is 100bp, as shown below:

Year	1	2	3	4	5	6	7	8	9	10
Fund Return	12.0%	7.0%	X	-3.0%	4.0%	3.3%	5.4%	3.8%	5.0%	3.7%
Index Return	12.6%	6.5%	1.2%	-5.0%	4.1%	3.2%	5.1%	5.7%	4.6%	3.8%

Note: Tracking error over the 10-year period = 100bp

(b) Explain how six different approaches could be used to reduce the tracking error.

ANSWER:

XYZ Associates created a five-bond portfolio as below that meets its client's "target dollar duration" requirement. This portfolio is to be managed to maintain the "target dollar duration".

Portfolio at the inception

	Market Value	Duration
Bond1	$10,800,000	1.25

Portfolio at some time t after the inception

	Market Value	Duration
Bond1	$10,260,000	0.60

Bond2	$10,300,000	4.45
Bond3	$10,600,000	5.05
Bond4	$10,000,000	5.65
Bond5	$10,100,000	5.95

Bond2	$10,403,000	4.10
Bond3	$10,812,000	4.55
Bond4	$10,050,000	5.05
Bond5	$10,201,000	5.55

(c) Propose two different trades (without using derivatives) that could be done at time t to meet the target dollar duration requirement.

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

A proposal is made to trade U.S. treasury futures contracts to maintain the target dollar duration. At time t, the price of the cheapest-to-deliver bond is $100,000, the conversion factor = 1.16 and the number of contracts to be traded to maintain the target dollar duration is 6.

(d) Calculate the duration of the cheapest-to-deliver bond, indicating if the futures trade is a "buy" or "sell".

ANSWER:

24. QFI PM Spring 2023, Question 4

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10

You recently joined Company ABC in its Investment Risk Department. ABC is an energy-related technology company. One of your mandates is to develop an Investment Policy Statement (IPS) for the company's defined benefit (DB) pension plan.

You are doing some research first before developing the IPS. You plan to calculate the plan funding ratio (with future compensation increases reflected) and understand the split between retired-lives and active-lives.

(a) Recommend the use of accumulated benefit obligation (ABO) or projected benefit obligation (PBO) to calculate the funding ratio.

ANSWER:

(b) Explain why the split between retired-lives and active-lives is important when assessing the funding status of the DB pension plan.

ANSWER:

You gather the following information from your research work:

- ABC is a small company.
- Most pension plan members are either active-lives and older than age 50, or are retired.
- Plan asset value: $300 million, ABO: $350 million, and PBO: $400 million.
- The company has rising earnings and a strong (low debt) balance sheet.
- The plan's portfolio is actively invested in energy sector.

(c) Describe the implications of the above information for the plan's risk objective.

ANSWER:

The IPS has been developed and the return objective has been set to 6% (equal to the discount rate used to determine the PV of liabilities). After several years of operating, the plan now has a funding ratio of 110%. Also, the Company expanded and hired a significant number of young employees and is still growing.

(d) Recommend an updated return objective.

ANSWER:

From the corporate risk management perspective, senior management has the following concerns:

- How to better manage pension investments in relation to operating activities?
- How to better coordinate pension investments with pension liabilities?

(e) Describe strategies that could address management's concerns.

ANSWER:

25. QFI PM Spring 2023, Question 7

Learning Outcome(s): 1b, 2l

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12, Ch 14; INV101-105-25: Addressing Built-in Biases in Real Estate Investment

(a) Contrast the valuations of REIT and direct investing from both the micro and the macro perspectives.

ANSWER:

(b) Explain the challenges related to behavioral finance in real estate investment when compared to equity market investment.

ANSWER:

Consider the following behavioral biases:

(i) Framing bias

(ii) Home bias

(iii) Herding bias

(c)

(i) Explain how each bias affects real estate investing.

ANSWER:

(ii) Describe workarounds for each bias.

ANSWER:

Your colleague made the following statements:

Statement A: "REIT A has an average cost of capital of 10%, REIT B has an average cost of capital of 12%. This implies REIT A can afford to pay more for property X than REIT B."

Statement B: "Income contributes the bulk of the total returns on real estate investment, as well as most of the volatility."

(d) Critique your colleague's statements.

ANSWER:

26. QFI PM Spring 2023, Question 8

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You were asked to evaluate the performance of your company's investment portfolio through performance attribution.

(a) Describe macro and micro performance attribution.

ANSWER:

You were given a draft micro attribution analysis using a fundamental factor model:

(%)	Portfolio Exposure	Normal Exposure	Factor Return (Beta)	Return
Market				5.05
Normal Portfolio				4.95
Cash Timing	2.05	0.05	-0.05	
Beta Timing	1.04	1.00	2.00	
-- Total Market Timing				
Growth	1.23	0.51	-0.55	
Size	-0.50	0.86	0.57	
Yield	-0.90	-0.54	2.44	
-- Total Fundamental Risk Factors				
Basic Industry	35.23	41.00	-0.04	
Financials	40.12	37.00	0.01	
Consumer	24.65	22.00	0.02	
-- Total Economic Sectors				

The zero factors are 0 for all fundamental factors. The actual portfolio return is 5.5%.

(b)

(i) Define Normal Exposure

ANSWER:

(ii) Explain the differences between normal exposure and portfolio exposure in the chart above.

ANSWER:

(c) Calculate the attribution of the active impact into market timing, fundamental risk factors, and economic sectors.

ANSWER:

(d) Calculate the portfolio return predicted by this model.

ANSWER:

27. QFI PM Spring 2023, Question 11

Learning Outcome(s): 2d, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12

CDF Fund, an education endowment fund of $150 million that supports and funds teaching and research for ABC university is due for annual asset allocation review.

The treasurer has prepared some capital information that will facilitate adjustment of the current year asset allocation.

ABC university has a return requirement of 6.77%. ABC does not want to borrow to purchase risky assets. No substantive relevant legal and regulatory factors or unique circumstances affect the asset allocation.

The risk objective is to accept lowest possible standard deviation of return and not greater than 8.0% while maximizing Sharpe Ratio.

The risk-free rate is 2%

	Return	Std Dev	US Equities	Asia Equities	Intermediate Bonds	Long Term Bonds	International Bonds	Real Estate	Sharpe ratio
1 US Equities	12.00%	22.00%	1	0.54	0.35	0.5	0.24	0.32	0.4545
2 Asia Equities	9.50%	18.00%	0.54	1	0.04	0.28	0.36	0.13	0.4167
3 Intermediate Bonds	4.25%	6.00%	0.35	0.04	1	0.85	0.48	0.11	0.3750
4 Long Term Bonds	5.25%	8.00%	0.5	0.28	0.85	1	0.38	-0.15	0.4063
5 International Bonds	5.60%	9.50%	0.24	0.36	0.48	0.38	1	0.12	0.3789
6 Real Estate	6.50%	13.00%	0.32	0.13	0.11	-0.15	0.12	1	0.3462

8 corner portfolios have been provided which define the minimum-variance frontier.

Corner Portfolio Number	1	2	3	4	5	6	Return	Std Dev	Sharp Ratio
1	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.00%	22.00%	45.45%
2	68.00%	32.00%	0.00%	0.00%	0.00%	0.00%	11.20%	18.71%	49.17%

3	49.57%	32.45%	0.00%	0.00%	0.00%	17.98%	10.20%	15.72%	52.16%
4	34.63%	25.14%	0.00%	0.00%	17.67%	22.56%	9.00%	12.56%	55.74%
5	0.00%	10.63%	0.00%	47.14%	14.41%	27.81%	6.10%	6.45%	63.58%
6	0.00%	10.36%	69.49%	0.00%	5.24%	14.91%	5.20%	5.58%	57.38%
7	0.00%	0.00%	93.33%	0.00%	0.00%	6.67%	4.40%	5.76%	41.67%
8	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	4.25%	6.00%	37.50%

(a) Recommend a strategic asset allocation (asset class weights) for the CDF Fund that satisfies the return requirements and risk objectives.

ANSWER:

The treasurer would prefer not to invest in real estate because real estate is highly illiquid, its return objective is below the target, has a high standard deviation above the target, and the Sharpe Ratio is low.

(b) Explain why real estate should be included in the current portfolio.

ANSWER:

Assume the fund changes its management strategy to maximize the mean-variance investor's utility $U_m = E(R_m) - 0.50R_A\sigma^2_m$, where expected return and standard deviation are in decimal form and 0.5 is a scaling factor.

Suppose the fund decides to restrict its choice in investing to portfolios 3 and 4.

(c) Calculate the values of the parameter R_A for which the fund would prefer portfolio 4 to portfolio 3.

ANSWER:

(d) Explain whether choosing portfolio 4 over portfolio 3 would be consistent with the expected risk aversion of an endowment fund.

ANSWER:

28. QFI PM Fall 2023, Question 6

Learning Outcome(s): 2b

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors;

ORD is a small sized US regional bank with deposits totaling $10 billion. ORD funds its time deposit (e.g Certificate of Deposit) and demand deposit (e.g. checking account) liabilities with long-term loans and securities. ORD also has fee income that roughly offsets the operating expenses.

- A $10 million endowment fund has been set up to manage a large donation made by a not-for-profit organization.
- The goal of the endowment is to provide perpetual funding to a charitable organization in the US, while maintaining the fund's long-term purchasing power.
- The spending rate of the endowment is 4.2% of its assets which are to cover the organization's expenses, which trend with the larger economy's inflation.
- In addition, the endowment has annual investment management expenses equal to 3% of assets annually.

(a) Compare the approach of Bank ORD and the endowment fund to managing three of the following:

(i) Liquidity risk

(ii) Tax concerns

(iii) Return objectives

(iv) Time horizon

ANSWER:

~~The donor is a believer in the success of ESG policies, and has stipulated that the endowment be a signatory to the Principles of Responsible Investing which has six principles.~~

1. ~~We will incorporate ESG issues into investment analysis and decision-making.~~
2. ~~We will be active owners and incorporate ESG issues into our ownership policies and practices.~~
3. ~~We will seek appropriate disclosure on ESG issues by the entities in which we invest.~~
4. ~~We will promote acceptance and implementation of the Principles within the investment industry~~
5. ~~We will work together to enhance our effectiveness in implementing the Principles~~
6. ~~We will each report on our activities and progress towards implementing the Principles~~

~~(b) Describe two actions to incorporate ESG for any two of the principles above (four actions in total).~~

~~ANSWER:~~

29. QFI PM Fall 2023, Question 7

Learning Outcome(s): 2e

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9, Ch 10

Your firm has been hired to evaluate the investment strategies of two clients.

Client 1 is a small property and casualty company with mostly auto claims, all payable within the next two years. Management is confident that future premium levels can be set without marketplace consequences to support future expected claim costs. They are also looking to re-evaluate both how they manage investment to fund the claim costs and the fully indexed fixed income portion of the surplus.

Client 2 is a medium sized insurance company that has been buying fixed payments pensions and recently started making bids for blocks of business with benefits tied to CPI. Typically, they receive cash or liquid high quality bonds to take on these liabilities. They are reviewing the current investment strategies in order to determine if any investment strategy changes are necessary.

You are preparing a ranking of different asset classes to address the inflation concerns of these two clients, ensuring that the liability profile of each client is considered.

~~(a) Justify a ranking, from best (1) to worst (3), for each of the two clients separately for the following asset classes:~~

- ~~Nominal Bonds~~
- ~~Commodities~~
- ~~Materials Equity~~

~~ANSWER:~~

~~Your colleague has suggested using US market REITS as a better asset class to hedge inflation as compared to Materials Equity. They have noticed that theory suggests that REITS would be good hedge against rising inflation due to liquidity risk of investing in property. They are asking your expertise in doing some additional research about the empirical evidence.~~

~~(b) Explain how the empirical evidence of REITs compares to the theory that REITS are a good inflation hedge.~~

~~ANSWER:~~

(c) ~~Assess whether REITs would be a better inflation hedge than Materials Equity.~~

~~ANSWER:~~

Client 2 is considering moving to a cash-flow matching dedication strategy.

(d) Describe two concerns that the portfolio managers might have, in applying a dedication strategy.

ANSWER:

For Client 1, the current strategy for the fixed income part of the surplus is using a pure bond index matching strategy. The client strongly believes that both interest rates and defaults will rise over the next two years.

(e) Explain how an active strategy could be used for Client 1.

ANSWER:

Ultimately you decide that your team is not in good position to monitor a fully active strategy and choose to use an Enhanced Indexing approach instead.

(f) Describe three additional ways that the Enhanced Indexing strategy can enhance the portfolio return.

ANSWER:

30. QFI PM Fall 2023, Question 8

Learning Outcome(s): 2d, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 6; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12, Ch 14

You are an investment actuary at ABC Insurance Company, reviewing an investment portfolio, P_0 (with return R_0) recommended by your predecessor. You are given the following information:

Portfolio P_0 information

- Expected return for P_0 is 10%
- Standard deviation of return is 0.16

Other information

- ABC's risk aversion scale, R_A is 4

ABC's targeted risk objective criteria

- Targeted expected utility is 5%, using the generic formula $U_m = E(R_m) - 0.5R_{A(}\sigma_{m)}^2$
- Targeted safety-first ratio is 0.4 with a corresponding minimal return level of 4%

(a)

(i) Calculate the minimum expected return required to satisfy the risk objectives.

ANSWER:

(ii) Explain how ABC's risk objectives would be impacted if ABC's risk tolerance increased.

ANSWER:

You are constructing a new portfolio consisting of equities, real estate, and bonds; however, your colleague does not understand why real estate is treated as a separate asset class.

(b) Explain how real estate meets two of the criteria of being categorized as a separate asset class.

ANSWER:

You identify corner portfolios CP1 and CP2, and your team proposes two other portfolios P1 and P2.

	Equities	Real Estate	Bonds
CP1	100%	-	-
CP2	33.4%	66.6%	-
P1	50%	50%	-
P2	-	25%	75%

(c) Explain whether P1 and P2 could potentially be corner portfolios.

ANSWER:

You want to explore using Monte Carlo simulation in asset allocating process as the portfolio back Universal Life liabilities.

(d) Explain why using Monte Carlo simulation in the asset allocating process would be beneficial to ABC.

ANSWER:

31. QFI PM Fall 2023, Question 10

Learning Outcome(s): 2d, 2e, 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 6, Ch 9, Ch 10

You are an actuary working in the ALM area of an insurance company.

Your manager asks you to consider the following statements with respect to ALM strategy for your company:

(i) If ABC wishes to take high levels of risk, the efficient frontier may provide useful insights into portfolios that optimize surplus risk

(ii) The duration of an asset cannot exceed its time to maturity

(iii) Modified Duration can be used to compare the relative sensitivity of two bonds to parallel changes in the yield curve

(a) Critique each of your manager's statements.

ANSWER:

You receive an up-front premium of $74M for a single, fixed liability cash flow of $100M due ten years from now.

Your available investment universe consists only of zero-coupon government bonds.

You plan to invest the premium in the following two government bonds, with proportions determined so as to match the dollar duration of the liability.

All rates are annualized and continuously compounded. There are no transaction costs or other expenses.

Bond	Term (yrs)
A	5
B	30

Initial yields for government bonds are given as follows:

Term (yrs)	Yield
5	3.25%
10	3.50%
15	3.75%
20	4.00%
25	4.25%
30	4.50%

(b) Calculate the initial dollar duration of the liability.

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

~~(c) Calculate the initial dollar safety margin.~~

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

(d) Calculate the initial investment in each of Bond A and Bond B that will dollar duration-match the liability.

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

Immediately after the bonds have been purchased, bond yields have changed to the following:

Term (years)	Yield
5	2.75%
10	3.10%
15	3.45%
20	3.80%
25	4.15%
30	4.50%

(e) Calculate the new positions in each bond that will restore the dollar duration-matching.

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

~~(f) Calculate the new dollar safety margin.~~

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

You are following a contingent immunization strategy, whereby you would immunize the portfolio with a bond which exactly matches the liability cash flow if the dollar safety margin falls to zero.

You are concerned about the risk that 10-year rates could decrease, with no change to the 5-year and 30-year rates.

(g) Approximate the further decrease in 10-year rates that would require immediate immunization of the portfolio (no change to the 5-year and 30-year rates).

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

You are considering including Monte Carlo simulation as an additional tool in your ALM program.

(h) Describe the advantages of adding Monte Carlo simulation to your ALM program.

ANSWER:

32. QFI PM Fall 2023, Question 13

Learning Outcome(s): 2i, 2J, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You oversee two portfolio managers:

- Manager 1 employs an analyst who does research and provides recommendations.
- Manager 2 looks for active gains to beat the market.

You wish to identify appropriate benchmarks and performance evaluation metrics for each of the managers.

(a) List four properties of a valid benchmark for performance evaluation.

ANSWER:

(b) Describe how to construct a custom security-based benchmark.

ANSWER:

You are given the following information for Manager 1's portfolio:

	Benchmark		Portfolio	
Economic Sectors	Weight	Return	Weight	Return
Basic Materials	60%	10%	40%	11%
Energy	40%	12%	60%	12%
Total Benchmark return =		10.80%		

(c) Assess the portfolio performance using the following attribution breakdowns:

(i) Pure selection allocation

(ii) Allocation/selection interaction

(iii) Within-sector selection

(iv) Total value added

ANSWER:

You are given the following information for Manager 2's portfolio:

	Average over Evaluation Period
Portfolio return	11%
Market index return	10%
Risk-free rate	2%

Estimated portfolio beta relative to market index = 0.5

(d) Calculate the following performance metrics for this portfolio:

(i) Jensen's alpha

ANSWER:

(ii) Treynor ratio

ANSWER:

You are considering the following performance evaluation options:

- Compare the manager's performance against the median manager return from a database of other account returns in similar institutions.
- Calculate a risk-adjusted performance metric to compare the manager's performance against the market using the CAPM model.

(e) Assess these two performance evaluation options.

ANSWER:

33. QFI PM Spring 2024, Question 2

Learning Outcome(s): 2g

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12

You are an investment analyst working at ABC Equities and are developing investment indices and passive investment vehicles.

You are given the following information on the four stocks that comprise the QXYZ index:

Stock	**Share Price, Dec. 31 2024**	**Share Price, Dec. 31 2025**	**Market Value ($M) of Shares, Dec. 31 2024**	**Market Value ($M) of Shares, Dec. 31 2025**
Q Corp	32.88	22.17	$11,349	$7,652
X Corp	19.54	28.96	$22,762	$33,735
Y Corp	23.84	44.79	$98,455	$184,975
Z Corp	58.47	50.23	$120,873	$103,839

(a) Calculate the returns of the QXYZ index using:

(i) Value-weighted method

(ii) Equal-weighted method

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

(b) Describe a key bias in the performance measurement for each of the two index weighting methods.

ANSWER:

An investment manager at your firm has a mandate for managing a G3000 index fund, which contains over 3,000 small-cap stocks. You're asked to consider the use of the full replication method and the stratified sampling method.

(c) Explain why the return on an index fund constructed using the full replication method may be less than the return of the underlying index.

ANSWER:

(d) Describe the stratified sampling method.

ANSWER:

(e) Recommend the most appropriate method for constructing the G3000 index fund.

ANSWER:

34. QFI PM Spring 2024, Question 6

Learning Outcome(s): 2c, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 19

ATW insurance company has several asset classes supporting its individual life portfolio. ATW uses a strategic asset allocation (SAA) and the assets, which are all domestic, are rebalanced at the end of every year

Asset Class	Target Allocation	Long-Term Expected Return
Cash Equivalent	5%	0.5%
Investment Grade Public Bonds	40%	4.0%
Private Placement Bond	20%	6.0%
Public Common Stock	20%	8.5%
Commercial Mortgage Loan	10%	6.5%
Real Estate	5%	6.0%

ATW is considering a tactical asset allocation (TAA) for the individual life portfolio to enhance investment return. TAA is frequently based on the following 3 principles:

1) Market prices tell explicitly what returns are available.
2) Relative expected returns reflect relative risk perceptions.
3) Market is rational and mean reverting.

You are given the following facts:

- Public Common Stock: volatility ratio has been exceeding the equity risk premium for 2 years
- Investment Grade Public Bonds: total return has been 1% over the past 5 years

(a)

(i) Explain principle 1) above

ANSWER:

(ii) Explain how principle 1) can help derive the long-term return expectations for Public Common Stocks.

ANSWER:

(b) Describe how principles 2) and 3) above may affect the tactical allocation of the Public Common Stocks and Investment Grade Public Bonds respectively.

ANSWER:

Within the Public Common Stocks asset class, you are asked to consider combining a current market portfolio with factor-replicating portfolios A and B, which replicate factors F_A and F_B respectively. Portfolio A has no exposure to factor F_B and Portfolio B has no exposure to factor F_A. You have the following views on expected portfolio returns:

Portfolio	Return in excess of the risk-free rate	Active Return in excess of the market return	Volatility	Active Risk
A		0.00%		4.00%
B		1.00%		2.50%
Market	6.00%		15%	

Returns for portfolio A and B have a correlation of -0.2 and are assumed to be uncorrelated to the market.

Using the generalized Treynor–Black result from the paper "Fundamental of Efficient Factor Investing" by Roger Clarke, Harindra de Silva & Steven Thorley:

(c)

(i) Calculate the Maximum possible factor Sharpe ratio for a portfolio composed of the above factors and the market portfolio.

ANSWER:

(ii) Calculate the excess return over the risk-free rate of the maximum possible factor Sharpe Ratio portfolio.

ANSWER:

35. QFI PM Spring 2024, Question 7

Learning Outcome(s): 2g

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12

You have been asked to review the funds available for your company's Variable Universal Life product.

There are currently three funds which are invested in individual securities to replicate a particular investment style.

The benchmarks currently in use to assess performance are as follows:

Fund	Investment Style	# of stocks used	Number of independent trades per year	Information Coeffficient
Fund A	Mid Cap Value	D	X	.03
Fund B	Large Cap Growth	E	Y	.02
Fund C	Small Cap Core	400	100	.05

The Information Coefficient is defined as the correlation between the forecasted return and the actual return.

You are given the following information about Fund B

Portfolio Statistics	Fund B	Market Benchmark
Number of stocks	100	750
Weighted Average Market Cap	$37b	$45b
Dividend yield	1.5%	2.1%
P/E	25	20

EPS Growth (5 year projected)	10%	12%
Earnings Variability of stocks	0.5	1.0
Sector Weights		
Consumer Discretionary	13%	13%
Consumer Staples	10%	10%
Energy	9%	9%
Finance	15%	20%
Health Care	4%	7%
Industrials	9%	9%
Information Technology	12%	7%
Materials	8%	8%
Telecommunications	10%	10%
Utilities	10%	7%

~~(a) Assess whether the stock selection above is consistent with a Growth Style.~~

~~ANSWER:~~

~~The funds do not allow short selling stocks.~~

~~(b) Explain two reasons why short selling stocks may be a strategy to consider.~~

~~ANSWER:~~

~~The expectation of each fund is to have a similar Information Ratio under Grinold and Kahn's Fundamental Law of Active Management.~~

~~(c)~~

~~(i) Calculate the number of annual independent trades per year necessary for Fund A to have the same Information Ratio as Fund C.~~

~~ANSWER:~~

(ii) ~~Explain why Portfolio B should require a higher number of annual trades in order to achieve the same Information Ratio.~~

~~ANSWER:~~

You are looking at the current fee structure of the funds. Below is relevant information to consider:

Fund	Invested Funds	Fee for first 200M	Fee above 200M	Expected Alpha
Fund A	500M	50bp	40bp	0.02
Fund B	1000M	100bp	50bp	0.04
Fund C	100M	20bp	10bp	0.0

You are considering a performance based fee for Fund A where you would pay Zbp + 10% in excess of the benchmark return.

(d) Calculate Z so that the total fees under either approach are equal.

ANSWER:

(e) Explain two additional features that could be added to the performance-based fee formula to better align the fund managers incentives with the your company's interests.

ANSWER:

36. QFI PM Spring 2024, Question 8

Learning Outcome(s): 2b, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

You provide portfolio management services to clients, working with a variety of assets.

One of your clients has frequent deposits and withdrawals to their account. They are anxious about the portfolio's performance and request periodic updates on the portfolio return.

(a)

(i) Compare the time-weighted rate of return and the money-weighted rate of return.

ANSWER:

(ii) Explain which measure you would use when reporting to your client.

ANSWER:

(b) Explain what an investment policy is and why it is important to portfolio design.

ANSWER:

You are given the following information for one of your managed stock portfolios:

	Investment Policy		Portfolio	
	Policy (Passive) Weight	Passive Return	Actual Weight	Active Return
Asset Class 1	60%	10%	50%	11%

Asset Class 2	40%	9%	50%	10%

(c) (*2 points*) Calculate the portfolio's return, attributed to each of the following dimensions:

(i) Investment policy

ANSWER:

(ii) Timing

ANSWER:

(iii) Selection

ANSWER:

(iv) Other

ANSWER:

(d) Describe the considerations of performance micro-attribution for fixed income portfolios.

ANSWER:

(e) Identify potential drawbacks to using past performance data to evaluate portfolio managers.

ANSWER:

37. QFI PM Spring 2024, Question 14

Learning Outcome(s): 2b, 2c, 2d

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

You are a consultant retained by Company MGC, a life and annuity insurance company that doing an internal review of its Asset Liability Framework and developing its first formal Investment Policy Statement (IPS). You are given:

- MGC is an industry leader in Whole Life insurance
- MGC has implemented several portfolio management concepts over time
- MGC has done extensive work understanding and describing its client(s) and all relevant parties and their duties while also establishing a clearly defined purpose
- MGC has documented appropriate investment goals and constraints along with explaining the investment strategies it utilizes

(a)

(i) Explain what MGC's portfolio management documentation is missing that an IPS would add.

ANSWER:

(ii) Explain how a formal IPS adds value to MGC

ANSWER:

You are given the following information about MGC's assets and liabilities:

- Asset Duration = 10 years
- Liability Duration = 10 years

- Total Assets = $10 Billion
- Total Surplus = $950 Million
- Weighted average credited rate of MGC's policies: 5%
- MGC's current portfolio yield: 4.53%
- Current 10-year Treasury rate: 3%

You are now working on reviewing MGC's investment strategy. One of the stated objectives in MGC's current investment document says:
"The investment strategy should support the company's policyholder liabilities while maintaining regulatory compliance."

The head of investments at MGC drafts a high-level proposal of the reallocation as follows:

Asset Class	Regulatory Surplus Charge*	Expected Yield	Current Allocation	Proposed Allocation
Investment Grade Bonds	2.00%	3.50%	65%	30%
High Yield Bonds	10.00%	6.00%	10%	10%
Structured Assets	2.50%	5.00%	5%	20%
Real Estate	5.00%	6.00%	10%	10%
Common Stock	45.00%	8.00%	10%	20%
Private Equity	50.00%	14.00%	0%	10%
Total			100%	100%
Weighted Expected Yield-->			4.53%	
Regulatory Surplus Charge-->			7.43%	
Total Surplus Charge = Weighted Surplus Charge(%)*Total Assets-->			742,500,000	

*Regulatory Surplus Charge represents the additional capital expected per asset class to maintain regulatory compliance

(b)

(i) Analyze the proposed investment strategy considering MGC's stated objectives

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

(ii) Construct a revised portfolio, starting with the "Current Allocation," and making exactly two 5% adjustments from one asset class into another that meets MGC's goals.

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

As you've been working with MGC, inflation has increased significantly resulting in the Federal Reserve raising interest rates —the 10-year treasury rate is now 7%. MGC is interested in the impact rising interest rates may have on its business.

(c)

(i) Explain how the current economic situation impacts MGC.

ANSWER:

(ii) Describe two actions MCG can take to mitigate its risk.

ANSWER:

38. QFI PM Fall 2024, Question 4

Learning Outcome(s): 2d

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6

Insurer XYZ is seeking to apply simulation techniques to evaluate asset allocations for its pension fund.

(a) List three considerations in which Monte Carlo simulation methods can help to confirm the quality of mean-variance or surplus optimization recommended allocations.

ANSWER:

You are assisting in this simulation exercise and have elected to apply a three-step asset-liability management method as defined by Sharpe. The objective function is:

$$U_m^{ALM} = E(SR_m) - 0.5R_A\sigma^2(SR_m)$$

(b) Describe each expression within the above objective function.

ANSWER:

The risk aversion of Insurer XYZ is 8.

You are asked to assess the following asset allocations for the portfolio:

Asset Allocation	**Expected Surplus Return**	**Standard Deviation of Surplus Return**	**U_m^{ALM}**
Current Portfolio	4%	10%	0
Alternative Portfolio A	?	14%	
Alternative Portfolio B	2%	?	

(c)

(i) Calculate the increase in expected surplus return required for Insurer XYZ to prefer Alternative Portfolio A over its current portfolio.

ANSWER:

(ii) Calculate the decrease in standard deviation required for Insurer XYZ to prefer Alternative Portfolio B over its current portfolio.

ANSWER:

Following application of the objective function and the assessment of various portfolios, you are asked to assess the simulation results for a given asset allocation.

(d)

(i) Recommend statistical measures by which to judge the projected performance of the portfolio with respect to the funded ratio.

ANSWER:

(ii) Propose a criterion that Insurer XYZ could utilize in determining the appropriateness of the portfolio.

ANSWER:

39. QFI PM Fall 2024, Question 5

Learning Outcome(s): 2g, 2h, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12, Ch 13, Ch 19; INV101-104-25: The Hidden Dangers of Passive Investing

You were hired by a small life insurance company called ABC Life Insurance as an Investment Actuary. The Chief Investment Officer (CIO) told you that ABC has a small equity portfolio, based on exchanged-traded funds (ETFs).

(a) Describe the economically significant differences between conventional index mutual funds and ETF's.

ANSWER:

ABC Life has been maintaining a passive investment approach in its equity portfolio.

(b) Explain the hidden danger in ABC's approach.

ANSWER:

A year later, ABC's equity portfolio began to explore semi-active equity management. It evaluated 3 investment managers using Grinold and Kahn's Fundamental Law of Active Management, considering the Information Coefficient (IC) and Breadth to compute the Information Ratio (IR).

Manager A follows 200 stocks with annual forecasts; IC of each forecast is 0.03.

Manager B follows 100 stocks with annual forecasts, IC for each forecast is 0.04.

Manager C follows 300 stocks, with 200 independent forecasts (IC is 0.02 for each), while the remaining 100 are dependent forecast (IC is 0.03 for each).

(c) Assess which manager gives the highest IR.

ANSWER:

The investment team at ABC Life is considering alternatives to its passive approach.

(d) Describe possible limitations of the semi-active stock selection approach.

ANSWER:

Manager X is a US value-oriented portfolio manager. You are given the following:

15% = Manager X's portfolio return

10% = S&P 500 Index return

14% = S&P 500 Value Index return

5% = The active risk taken by the Manager X, based on her investment strategy.

4% = The misfit risk that arises from the Manager X's unintentional deviation from her investment strategy or benchmark.

(e) Calculate

(i) Total active risk of Manager X

ANSWER:

(ii) IR of Manager X

ANSWER:

(f) Explain how the distinction between "true" and "misfit" can be used in portfolio construction optimization.

ANSWER:

40. QFI PM Fall 2024, Question 7

Learning Outcome(s): 2a, 2b, 2c

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

MDW is an insurance company selling life insurance and disability income products. MDW has $30 billion in assets that are currently being internally managed by their investment department. MDW is considering outsourcing the investment management to ORD, a third-party investment management company.

(a) Describe the four planning steps that ORD should go through as part of the portfolio management process.

ANSWER:

(b) Describe active, semi-active, and passive investment strategies.

ANSWER:

(c) Describe a situation where the portfolio's actual asset allocation differs from the strategic asset allocation.

ANSWER:

ORD has created an IPS and has implemented this plan. One year later, MDW announces that it is merging with ABC, another insurance company which is heavily into the annuities market.

(d) Explain how the merger impacts ORD's IPS.

ANSWER:

Five years later ORD conducts an assessment of its investment performance.

(e) Identify two components that are part of this assessment.

ANSWER:

41. QFI PM Fall 2024, Question 8

Learning Outcome(s): 2i, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Your manager, in creating a new asset portfolio, has decided which asset classes to include and which to exclude from the portfolio.

(a) Describe three additional steps in designing this new investment portfolio.

ANSWER:

(b) Critique the benchmarks below in measuring portfolio performance.

(i) Investment style index

ANSWER:

(ii) Factor model

ANSWER:

A fund has the following cash flows and quarterly simple returns.

Quarter	Cash flow	Quarterly simple Return
0	1000	
1	0	0.06
2	500	-0.03
3	0	0.05
4	0	0.02

(c) Calculate both the time-weighted rate of return (TWR) and the money-weighted rate of return (MWR) over the year.

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

A hedge fund is holding substantial short positions in certain assets.

(d) Explain the challenges in determining the rate of return in a long/short hedge fund.

ANSWER:

(e) Describe the difficulty in creating benchmarks for hedge funds and recommend a solution.

ANSWER:

42. QFI PM Fall 2024, Question 9

Learning Outcome(s): 2g

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12

Company FDE sells fixed index annuities. You have been asked by Company FDE management to manage the equity portfolio.

(a) Describe the following index weighting choices, including their respective biases.

(i) *Price Weighted*

ANSWER:

(ii) *Value Weighted*

ANSWER:

(iii) *Equal Weighted*

ANSWER:

In your portfolio, you have a long position in S&P 500 index, which is a value-weighted index, as well as an equal and opposite short position in S&P 500 Equal Weight index. Suppose the share price of the second largest company in the index by market capitalization dropped by 10% and no other S&P 500 share price changes have occurred.

(b) Explain the expected net change in your portfolio as the result of this drop.

ANSWER:

You are now asked to construct a portfolio to track the S&P 500 index utilizing full replication, stratified sampling, or optimization.

(c) Compare these three methods.

ANSWER:

43. QFI PM Fall 2024, Question 12

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10

You are on an ALM team and given the following information from your manager:

A portfolio has bonds X, Y, and Z		
Bond	Duration	Market Value
X	4.8	$ 5.0M
Y	7.3	$ 3.2M
Z	12.7	$10.4M

The cheapest-to-deliver bond for a futures contract has:

- Price of $100,000
- Duration of 5
- Conversion factor of 1.2

Your manager has a target dollar duration for the portfolio of $150M and is interested in using futures contracts to achieve this.

(a) Calculate the number of futures contracts your manager needs to buy or sell to meet the $150M dollar duration target.

ANSWER:

Your manager is happy with your work and, as a follow-up, is interested in using interest rate swaps to achieve the target dollar duration. In addition to bonds X, Y, and Z above, your manager gives you the following information about the interest rate swap:

- The underlying fixed rate bond has a price of $100,000 and a duration of 6.5

- The underlying floating rate bond has a price of $100,000 and a duration of 0.4

(b) Calculate the amount and position in the swap needed to match the $150M target dollar duration.

ANSWER:

Your manager is interested in learning more about using swaps and futures to manage duration targets.

(c) Compare using futures or interest rate swaps to meet the target dollar duration.

ANSWER:

~~A year later you are working with a U.S fixed income fund that has holdings in yen-denominated Japanese bonds. Your manager is considering whether to hedge the funds' exposure to the yen with a dollar-yen forward contract. You are given:~~

- ~~U.S 1-year return = 4%~~
- ~~Japanese 1-year return = 4.5%~~
- ~~Your manager expects the Yen to appreciate against the U.S. dollar by 0.8%~~
- ~~Interest Rate Parity holds~~

~~(d) Recommend whether your manager would hedge the fund's exposure using dollar-yen forward contracts.~~

ANSWER:

44. ILA LAM Fall 2023, Question 4

Learning Outcome(s): 2a

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5

NDV Life sells a portfolio of fixed annuities. They recently experienced an excess cash inflow of 320 million and are evaluating asset mixes to reinvest the cash.

The below asset mixes are being considered. All assets pay annual coupons and have no principal repayments within the next five years.

Asset Mix	Expected Return	Standard Deviation of Return
W	9.0%	19%
X	4.5%	10%
Y	7.9%	14%
Z	6.9%	12%

NDV anticipates an excess cash outflow of 15 million in one year due to a large block of deferred annuities exiting their surrender charge period. They want to fund the cashflow with coupons from the selected asset mix rather than sell assets.

NDV recently underwent an internal risk tolerance review by surveying key stakeholders and aggregating the results based on a tolerance scale of 1 (minimal risk aversion) to 8 (significant risk aversion). The resulting company score was 4 out of 8.

(a)

(i) Calculate NDV's expected utility (also referred to as "risk-adjusted return") for each asset mix.

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

(ii) Calculate the safety-first ratio from Roy's safety-first criterion for each asset mix.

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

(iii) Recommend an optimal asset mix. Justify your answer.

ANSWER:

45. ILA LAM Fall 2023, Question 4

Learning Outcome(s): 2b, 2c, 2d

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6

Your company sells universal life policies with minimum interest rate guarantees in a saturated and competitive market. Senior management has stated solvency is one of their primary concerns given the company stock was recently downgraded.

(a)

(i) Describe the return objectives and risk tolerance for the company's investment policy statement.

ANSWER:

(ii) Identify four investment constraints the company should consider when managing their portfolio.

ANSWER:

The following is the company's current asset allocation strategy:

Asset Class	Target Allocation	Permissible Range
Treasury bonds	25%	20% - 40%
Bonds (municipal and corporate)	25%	20% - 40%
Equities (domestic, international, and mortgages)	20%	10% - 30%
Commercial paper	15%	5% - 25%

Cash	15%	5% - 25%

Your manager believes the asset allocations should be adjusted over time as the market shifts.

(b) Assess the asset allocation strategy.

ANSWER:

(c) Critique each of the following statements for structuring a portfolio:

A. You can evaluate and identify assets with misaligned credit ratings to build a portfolio that will outperform a benchmark.

ANSWER:

B. The assets purchased should be matched to the average duration of the liabilities. By doing this, it will protect against all changes in the market yield curve.

ANSWER:

C. A portfolio should be built to track a benchmark index. This can reduce fees compared to investing in the assets that are part of the index directly. Given it is unlikely the portfolio will perfectly track the index, the focus for selecting assets should be on expected returns.

ANSWER:

D. Interest rate swaps can help reduce interest rate risk and improve returns. You can also consider buying forwards for specific points in the future as an alternative.

ANSWER:

(d) The company is evaluating bonds to add to the portfolio that backs a 10-year liability. Prevailing market interest rates are increasing and expected to continue to rise. You are given the following information:

Bond	Coupon Rate	Coupon Frequency	Term (years)	Yield to Maturity	Maturity Value
Bond 1	11%	Semi-annual	10	5.0%	$1,000
Bond 2	7%	Semi-annual	20	6.1%	$1,000
Bond 3	0%	N/A	15	2.2%	$1,000
Bond 4	6%	Semi-annual	5	8.4%	$1,000

(i) Calculate the price of each bond.

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

(ii) Recommend a bond to add to the portfolio from the options above. Justify your answer.

ANSWER:

46. ILA LAM Fall 2024, Question 5

Learning Outcome(s): 2c, 1a, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12, Ch 14; The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011; Handbook of Fixed Income Securities, Fabozzi, Frank J., 9th Ed Ch 10, Ch 22

Your company invests based on a tactical asset allocation (TAA) framework and is considering changing to strategic asset allocation (SAA).

(a) Describe two differences between TAA and SAA.

ANSWER:

(b) Critique the following statements regarding asset allocation:

A. We should never add an asset class to our portfolio if the Sharpe ratio of the new asset class is lower than the Sharpe ratio of the existing portfolio.

ANSWER:

B. Measuring growth based on a money-weighted return basis will always be materially different from using a time-weighted return basis.

ANSWER:

C. Yield-to-maturity considers interest-on-interest, and it assumes that the coupon payments can be reinvested at an interest rate equal to the coupon rate.

ANSWER:

D. Prepayments on a mortgage only occur when rates decrease.

ANSWER:

E. If the default rate on a corporate bond is higher than its credit spread, it would always be preferable to invest in treasuries rather than that particular corporate bond.

ANSWER:

5. Continued

(c) Your investment team is seeking to increase yield and is investigating alternative assets. Critique the following statements:

A. As it is outside the expertise of an insurance company and it is hard to model, real estate investment trusts should be avoided.

ANSWER:

B. Private equity should be managed using tactical asset allocation.

ANSWER:

C. Collateralized loan obligations have minimal to no risk, given there is sufficient diversification in the underlying pooled loans.

ANSWER:

D. Energy transition infrastructure is a safe investment vehicle for insurance companies to invest in.

ANSWER:

47. QFI PM Fall 2022, Question 4

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 19

You have recently been hired by a pension plan to assist with designing and implementing a de-risking strategy for the plan. The plan is currently overfunded and uses an asset-only approach for managing the investment portfolio. A

colleague has proposed moving to an asset liability management (ALM) approach to better manage the pension plan's overall risk.

~~(a) (*0.5 points*) List two reasons why it may be appropriate to use an ALM approach for the pension plan.~~

~~ANSWER:~~

In order to help improve the risk-adjusted performance of the pension plan, the portfolio management team is investigating the use of the following three alternative assets classes:

- TIPS
- Real estate (direct ownership)
- Private equity

Based on their analysis, the current portfolio and proposed asset classes have the following return characteristics.

	Current Portfolio	TIPS	Real Estate	Private Equity
Expected total return (annual)	6%	8%	7%	10%
Standard deviation (annual)	10%	20%	18%	30%
Correlation with current portfolio	1	0.7	0.6	0.8
Duration	20	19	N/A	N/A

(b) (*2.5 points*) For each of the alternative asset classes:

(i) (*1 point*) Calculate the Sharpe ratio, assuming a 3% risk-free rate.

ANSWER:

(ii) (*1.5 points*) Assess whether adding the asset class to the portfolio achieves a mean-variance improvement.

ANSWER:

While the primary goal of the alternative assets would be to improve the risk-adjusted expected return of the portfolio, the portfolio management team is also considering the plan's key features. In particular:

- The pension benefits are indexed to inflation
- A large proportion of members are at or near retirement age
- Plan members have the option to take the cash value of their pension at termination or retirement

(c) (*2 points*) Evaluate how well each asset class addresses the above-mentioned concerns.

ANSWER:

(d) (*1 point*) Recommend an asset class in which to invest.

ANSWER:

48. QFI PM Spring 2023, Question 5

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

You are a fund manager at a large defined benefit pension plan. You are given the following statistics on two portfolios that could be used to back your pension liability:

Year	Portfolio 1	Portfolio 2	Liability	Return (Portfolio 1)	Return (Portfolio 2)
2016	101	101	100		
2017	103	103	102	1.98%	1.98%
2018	104	105	104	0.97%	1.94%
2019	109	108	106	4.81%	2.86%
2020	110	109	108	0.92%	0.93%
2021	114	112	110	3.64%	2.75%
Mean return				2.46%	2.09%
Standard Deviation				1.71%	0.78%

The risk-free interest rate is assumed to be 1.5%.

(a) (*1 point*) Justify, based on the Sharpe Ratio, which portfolio is preferable in the asset-only asset allocation strategy?

ANSWER:

(b) (*1 point*) Describe the shortcomings of the Sharpe ratio in measuring the trade-off between risk and return in an asset-liability framework.

INV 101
LEARNING OBJECTIVE 3

CATEGORIZED PAST EXAM QUESTIONS

These questions are representative of those which may be asked of candidates sitting for the INV 101 Portfolio Management assessment. These questions are intended to represent the depth of understanding required of candidates. Illustrative Solutions are provided separately.

The questions from this study note are taken from past SOA examinations. Most of these questions are taken from the previous QFI PM examinations. Sub-parts of a question were removed or struck-through if the reference material no longer appears on the current Syllabus.

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1. QFI PM Fall 2020, Question 13

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3

You have been asked to build a credit risk model for a portfolio of 1000 residential mortgages. You make the following working assumptions:

- Each mortgage has an exposure of $100,000
- Mortgages are not independent of each other
- All mortgages have similar risk of default
- The probability of default is expressed as p = p(Z), where Z is a random variable

You first decide to model defaults using a binomial-mixture model, where the default probability p(Z) = exp (Z) where Z is normally distributed with mean μ = ln(1/40) and variance σ^2 = ln(4), so that E[p(Z)] = exp($\mu+\sigma^2/2$).

(a) Identify desired characteristics of the credit risk model that make the choice of p(Z) important.

ANSWER:

(b) Calculate the following:

(i) Expected probability of default for a mortgage

(ii) Variance of the probability of default

(iii) Covariance between the number of defaults for any two mortgages

(iv) Variance of the number of defaults for the portfolio

ANSWER:

You then decide to explore beta-binomial mixture models for modeling the defaults in that portfolio. You have independently estimated that the probability of default

for a mortgage is 10% and the default correlation between any two mortgages is 10%, and you want to calibrate your model based on these values. You also assume that the recovery rate is 0% upon default of a mortgage.

(c) Calculate the amount of capital required to cover expected losses plus two 2 standard deviations above the expected losses due to default for the portfolio.

ANSWER:

(d) Describe two limitations of binomial-mixture models.

ANSWER:

You decide to use the CreditRisk+ model described in Bolder. After some further analysis, you realize that your portfolio is not homogeneous, but can be logically divided into 3 main groups each having a different risk of defaults: Urban, Suburban and Rural. You assume that this classification explains 70% of the default probability, the rest being related to the general economic condition, and therefore set $w_1 = 30\%$. You are given the following additional information:

Group	Urban	Suburban	Rural
Expected Probability of Default	10%	12%	8%

The correlation factor between Suburban and Urban mortgages is 40%.

(e) Calculate the correlation factor between Urban and Rural mortgages.

ANSWER:

2. QFI PM Fall 2020, Question 14

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4

You are modelling defaults for a bond portfolio consisting of 100 obligors. You decide to use a Gaussian threshold model, where:

- Y_i are latent variables defined by $Y_i = \sqrt{\rho} G + \sqrt{1-\rho}\, \epsilon_i$,
- G and ϵ_i are independent, identically distributed standard normal random variables,
- ϵ_i are independent, for all i, and
- $0 \leq \rho \leq 1$.

(a) Derive the covariance matrix of $[Y_1, Y_2]$ by determining $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, and identify their joint distribution

ANSWER:

You are given a default threshold K_i for each latent variable Y_i, where default occurs when Y is below the threshold K. You define:

- p_i as the unconditional probability of default for obligor i
- $p_i(G)$ as the probability of default for obligor i, conditional on G

(b) Determine an expression for the values of G which will satisfy the condition $p_i < p_i(G)$, for a given value of ρ.

ANSWER:

(c) Explain why the default correlation between obligors is different than the correlation between latent variables.

ANSWER:

You decide to change the latent variables to $X_i = \sqrt{\frac{v}{W}}\left(\sqrt{\rho}G + \sqrt{1-\rho}\,\epsilon_i\right)$, where *W* is a $\chi^2(v)$ independent random variable and $v > 2$ represents the degrees of freedom.

(d) Describe advantages that a threshold model using X_i as latent variables has over the Gaussian threshold model using Y_i.

ANSWER:

You are given that the covariance between any two X_i is 20% and the expectation of 1/W is 0.0556.

(e) Calculate the correlation between any two X_i.

ANSWER:

3. QFI PM Spring 2021, Question 8

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13

Insurance Company ABC is a fast growing life insurance company selling an array of life and annuity products.

Senior management is considering strategies intended to improve and stabilize its earnings:

- Introduce high yield bonds to the general account assets.
- Use interest rate swap or swaption transactions to hedge the sensitivity to interest rate movements of the variable annuity reserves.

- Customize a life insurance product tailored to high net worth individuals, using a stop-loss reinsurance transaction to control the tail risk.

(a) Describe each strategy's credit risk and any implications.

ANSWER:

(b) Describe four dimensions by which to analyze and compare the credit exposures of individual contracts.

ANSWER:

(c) Describe stress testing for credit risk and how it can complement quantitative risk measurement approaches such as value-at-risk.

ANSWER:

(d) Describe the purpose and key aspects of each of credit portfolio management (CPM) levels 1 and 2, as described in Handbook of Credit Risk Management.

ANSWER:

4. QFI PM Spring 2021, Question 8

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4

You are asked to model losses due to defaults on a bond portfolio consisting of 1000 obligors with a total par value of 2 billion. You decide to model the losses using a one-factor Gaussian threshold model with the following latent variable for each obligor n:

$$y_n = \sqrt{10\%}\, G + \sqrt{90\%}\, \in_n$$

where G and $\in_n$ are independent and identically distributed standard normal variates for all $n \in \{1, \ldots, 1000\}$.

Your manager asks you to use the homogenous portfolio approximation for your model, as described in "Credit Risk Modelling" by Bolder.

(a) Describe any simplifying assumptions or insights required in order for this approximation to be valid.

ANSWER:

You decide to use your analytic approximation with an assumption that the probability of default for any obligor in the portfolio is 1%.

(b) Calculate the probability that the number of defaults for the portfolio is less than or equal to 15, using your analytic approximation.

ANSWER:

You decide to revise your model and modify the latent variable for each obligor in the Gaussian threshold model to the following:

$$y_n = \sqrt{V}\left(\sqrt{10\%}\, G + \sqrt{90\%}\, \in_n\right)$$

where G and ϵ_n are independent and identically distributed standard normal variates for all $n \in \{1, \ldots, 1000\}$ and V is a gamma distributed random variable.

(c) Describe drawbacks of this revised model.

ANSWER:

You are given the following facts:

I. the kurtosis of y_n is

$$K(y_n) = \mathbb{E}\left(\left(\frac{y_n - \mathbb{E}(y_n)}{\sqrt{\text{var}(y_n)}}\right)^4\right) = 3\frac{\mathbb{E}(V^2)}{\mathbb{E}(V)^2} = 4, \text{ and}$$

II. the covariance between y_n and any y_m is 8%

(d) Calculate $E[V^2]$.

ANSWER:

5. QFI PM Fall 2021, Question 3

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4

You have been tasked with modelling the defaults for two bonds in an investment portfolio. You decide to use a Gaussian threshold model for N bonds, as follows:

y_n are latent variables defined by:

$$y_n = \sqrt{\rho_n}G + \sqrt{1-\rho_n}\varepsilon_{n,} \cdot n = 1, \ldots, N$$

$G, \varepsilon_1, \ldots, \varepsilon_N$ are independent, identically distributed standard normal random variables

$$0 \le \rho_n \le 1$$

(a) Derive the covariance matrix of $[y_1, y_2]$.

ANSWER:

One of your coworkers suggests modelling the latent variables in a different way, as follows:

y_n are latent variables defined by:

$$y_n = \sqrt{\rho} G + \sqrt{1-\rho}\varepsilon_n, \cdots n = 1, \ldots, N$$

$G, \varepsilon_1, \ldots, \varepsilon_N$ are independent, identically distributed standard normal random variables

$$0 \le \rho \le 1$$

(b) Explain the implications of using the simplified model your coworker recommends.

ANSWER:

You define a default trigger for your model as follows:

$$\mathbb{I}_{\mathcal{D}_n} \equiv \mathbb{I}_{\{y_n \le K_n\}} = \begin{cases} 1: \text{ when firm } n \text{ defaults before time } T \\ 0: \text{ otherwise} \end{cases}$$

You are also given:

$$p_n = \mathbb{E}\left(\mathbb{I}_{\mathcal{D}_n}\right), \quad p_{m,n} = \mathbb{E}\left(\mathbb{I}_{\mathcal{D}_m}\mathbb{I}_{\mathcal{D}_n}\right)$$

(c) Derive an expression for $\rho\left(\mathbb{I}_{\mathcal{D}_1}, \mathbb{I}_{\mathcal{D}_2}\right)$, the correlation between default variables $\mathbb{I}_{\mathcal{D}_1}$ and $\mathbb{I}_{\mathcal{D}_2}$.

ANSWER:

(d) Explain how the expression for the correlation derived in part (c) compares to the correlation between latent variables y_1 and y_2.

ANSWER:

Your coworker is considering an alternative default trigger specification:

$$\mathbb{I}_{\mathcal{D}_n} = \begin{cases} 1 \; if \; y_n = K_n \\ 0 \; if \; y_n \neq K_n \end{cases}, \; n = 1, \ldots, N$$

K_n are constant

(e) Explain why it would be inappropriate to use this default trigger as defined by your coworker.

ANSWER:

6. QFI PM Fall 2021, Question 11

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3

You have been asked to build a credit risk model for a portfolio of *n* obligors. You decide to use the one-factor CreditRisk+ model as described in Bolder, with the parameterization introduced by Wilde where:

$$p_n(S) \equiv P\left(I_{Dn} = 1 \middle| S\right) = p_n(\omega_0 + \omega_1 S)$$

You are given that S follows a gamma distribution $S \sim \Gamma$ (a,b), with shape parameter *a* and rate parameter *b*.

(a) (*1 point*)

(i) State the relationship between ω_0 and ω_1.

ANSWER:

(ii) Explain ω_0, ω_1 and S using the general ideas of the CAPM framework.

ANSWER:

(b) (*1 point*) Describe how the CreditRisk+ model in part (a) addresses one major shortcoming of binomial- and Poisson-mixture models.

ANSWER:

You notice that your portfolio can be logically classified into 3 main groups, each having a different probability of default: A, B, and C. You further assume that S follows a gamma distribution Γ (a=0.01, b=0.01). You are given the following additional information:

Group	A	B	C
Expected Probability of Default	5%	10%	15%

The correlation of defaults between groups A and B is 50%

(c) Calculate each of the following:

(i) The percentage of default probability that can be explained by this classification

ANSWER:

(ii) The variance of conditional default probability for C

ANSWER:

(iii) The variance of S

ANSWER:

After some analysis, you decide to use a multi-factor version of the CreditRisk+ model instead of the one-factor version.

(d) Describe critical assumptions that are needed for the multi-factor version of the model.

ANSWER:

7. QFI PM Spring 2022, Question 10

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3

(*5 points*) You have been asked to build a credit risk model for a portfolio of 100 mortgages.

You are given the following assumptions:

- The mortgages are not independent of each other

- The mortgages all have a similar risk of default

(e) (*1 point*) Describe a key shortcoming of the binomial and Poisson independent-default setting models, and how the mixture models address this shortcoming.

ANSWER:

You first decide to model defaults using a binomial-mixture model where the default probability

$p(Z) = \exp(Z)$, where Z is normally distributed with mean $\mu = \ln(1/20)$ and variance $\sigma^2 = \ln(9)$, so that $E[p(Z)] = \exp(\mu+\sigma^2/2)$. $Var(p(Z)) = (\exp(\sigma^2)- 1) \times \exp(2\mu+\sigma^2)$.

(f) (*1 point*) Calculate the following:

(i) Expected number of defaults for the portfolio

ANSWER:

(ii) Covariance of the default indicators for any two issuers

ANSWER:

After further research, you decide to model defaults using the Poisson-Gamma approach. The key idea of the Poisson-mixture approach is to randomize the arrival intensity and, indirectly, the default probability. You assume that $\lambda_n \equiv \lambda(S)$, where S follows a gamma distribution $S \sim \Gamma(2,4)$, with mean $\mu = 0.5$ and variance $\sigma^2=0.125$, so that $E(p(S)) = E(S)$.

(g) (*1 point*) Explain one advantage of mixing the Poisson model with another distribution, such as the Gamma distribution.

ANSWER:

(h) (*2 points*)

(i) Calculate the probability that there are exactly 2 defaults for the portfolio.

ANSWER:

(ii) Calculate the default correlation ρ_D for any two issuers using the quick and dirty calibration method described in the Bolder reading (assuming p(S)=S).

ANSWER:

8. QFI PM Spring 2022, Question 14

Learning Outcome(s): 3a

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 1, Ch 4

BYR bakery enters into a supply agreement with SLR, a small, recently established producer of organic flour. The agreement specifies that BYR will buy 1,000 kg of

organic flour from SLR each month for a term of three years. BYR will pay $1,000 per month, 30 days before delivery.

(a) (*0.5 point*) Describe the credit risk present in this agreement.

ANSWER:

(b) (*2 points*) Describe the four parameters of credit risk for each of the parties.

ANSWER:

9. QFI PM Spring 2022, Question 15

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1, Ch 2

You are reviewing the credit risk of a portfolio of 1,000 corporate bonds from various companies, with a total value of $1,000,000.

(a) State a formula defining the default loss random variable in terms of the exposure at default and recovery rate of each bond, giving definitions for each term in the formula.

ANSWER:

To start, you make some simplifying assumptions:

- the credit risks of the bonds are independent,
- each bond has a homogenous exposure of $1000 and default probability of 2%, and
- the recovery rate is zero.

(b) Calculate the variance of the default loss defined in part (a).

ANSWER:

You decide to calculate a VaR using a normal approximation to the binomial distribution.

(c) Calculate the approximate 95th percentile VaR of the default loss.

ANSWER:

10. QFI PM Fall 2022, Question 10

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13

You are an actuary working for ABC Life Insurance Company, which is domiciled in Country S. ABC currently holds US$100M in assets backing its liabilities, and these assets solely consist of sovereign bonds issued by Country S.

ABC uses a simplified internal rating system where A* includes all S&P ratings from A to AAA, similarly B* and C* includes all S&P ratings B to BBB, CC to CCC respectively. D means defaulted.

Country S sovereign bonds are currently rated BBB by S&P.

The one-year transition rates of the sovereign bonds are assumed to be the following:

From/To	A*	B*	C*	D
A*	97.0%	2.5%	0.5%	0.0%
B*	4.0%	93.0%	2.5%	0.5%
C*	0.0%	33.0%	50.0%	17.0%
D	0.0%	0.0%	0.0%	100.0%

You make the following simplified assumptions for the sovereign bonds:

At the end of each year,

- If the rating is upgraded to A*, the bond price will increase by 10%.
- If the rating is downgraded to C*, the bond price will decrease by 20%.
- If the rating is unchanged, the bond price will remain unchanged.
- The recovery rate in the event of default is 30%.

(a) Identify the credit risk exposures of ABC Life Insurance.

ANSWER:

(b) Calculate the expected loss of ABC Life Insurance at the end of 1 year.

ANSWER:

(c) Calculate the probability of bond defaulting at any point during the first 2 years.

ANSWER:

11. QFI PM Fall 2022, Question 15

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1, Ch 2

Bank ABC is constructing a new credit portfolio, which initially consists of two identical but independent obligors.

You are given the following:

- Total portfolio exposure-at-default is equal to the total portfolio value of $200 million.
- Default probability and severity for the obligors are independent.
- Each obligor has equal initial exposure-at-default of $100M.
- Annual default probability of each obligor $p_i = 0.05$
- Recovery rate following default $R_i=0.3$

You define *L* as the loss on this credit portfolio over one year.

(a) Describe one advantage and one disadvantage of one-factor credit risk modeling.

ANSWER:

(b) Calculate the expectation and volatility of *L*.

ANSWER:

ABC plans to grow and diversify its portfolio by adding new obligors. All obligors are assumed to be identical but independent, and each has an initial value and exposure-at-default of $100M.

ABC utilizes a risk metric *S*, which is defined as the volatility of credit portfolio losses over one year as a percentage of the portfolio exposure.

(c)

(i) Derive an expression for the volatility of *L* as a function of the number of obligors *N*.

ANSWER:

(ii) Calculate the minimum number of obligors needed to reduce ABC's risk *S* below 5%.

ANSWER:

(d)

(i) Explain *the Law of Rare Events* as described in the Bolder reading.

ANSWER:

(ii) Derive an approximation for the volatility of L based on *the Law of Rare Events* for large *N*, and considering p = 0.05 to be very small.

ANSWER:

ABC has grown its portfolio to a total value of $5 billion.

(e)

(i) Calculate the value of risk metric S using the approximation from (d)ii above.

ANSWER:

(ii) Compare your estimate to the value obtained using an exact calculation.

ANSWER:

12. QFI PM Spring 2023, Question 9

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13

ABC Life is an insurance company that sells a mixture of insurance products including Term and Whole Life, Immediate and Deferred Annuities, and Universal Life. You joined ABC Life as its first actuary on the credit portfolio management team.

ABC Life's approach for supporting its liabilities consists of the following elements:

- ABC Life entered a reinsurance treaty with a reputable AA rated reinsurer that covers any excess mortality loss over 100% of the latest industry mortality table for life insurance.
- ABC Life entered an interest rate swap agreement with FGH Bank as follows:
    - Notional amount of $100M.
    - FGH Bank pays ABC Life a fixed rate of 1%.
    - ABC Life pays FGH Bank the one-year point on the US Treasury par yield curve.
    - The term of the swap is 5 years.
- ABC Life underwrites $100M in commercial mortgage loans, with the underlying real estate as collateral.
- ABC Life invests $100M in government and municipal bonds from emerging markets such as Brazil, Russia, India, and China.
- ABC Life invests $100M in funds tracking the S&P 500 index.

(a)

(i) Identify the source of credit risk, if any, inherent in each element of ABC Life's current approach.

ANSWER:

(ii) Assess qualitatively the degree of credit risk in each element.

ANSWER:

ABC Life just started monitoring credit risks exposure. You consider the team to be a Level 1 credit portfolio manager, as described in the Handbook of Credit Risk Management.

(b) Describe three key functions of the credit portfolio management team.

ANSWER:

You have been given the goal of improving the credit portfolio management team to Level 2, as described in the Handbook of Credit Risk Management.

(c) Explain three additional key functions that need to be implemented in order to achieve this goal and the importance of each function.

ANSWER:

13. QFI PM Fall 2023, Question 5

Learning Outcome(s): 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 13

You are working as a credit risk analyst for Company X, a large manufacturing company with significant credit exposure to Company Y, a raw goods producer. You have recently been assigned to work on a project with the Credit Portfolio Management (CPM) team.

(a) (*1 point*) Explain the two key activities in an active CPM strategy (as defined in Bouteille).

ANSWER:

Your manager has told you that Company Y's financial strength could be significantly threatened by large amounts of rainfall in the continental United States.

(b) (*1.5 points*) Recommend an active CPM strategy to manage the risk that Company Y defaults on its obligations to Company X.

ANSWER:

Your manager makes the following statements about CPM:

I. Credit Risk Assessment and CPM are essentially the same discipline, requiring the exact same skill set and providing similar insights into a company's credit risk position. Both areas focus on analyzing individual transactions rather than the portfolio at-large.

II. Advances in liquidity and analytical tools have led to evolution of the CPM process. In particular, it has become more difficult in the last 20 years to buy/sell exposures to execute rebalancing transactions, which has turned CPM into a purely academic exercise.

III. Basic CPM can and should be viewed as the absolute minimum amount of activities that should be performed by any firm exposed to credit risk. It does not require sophisticated modelling in order to add value to an enterprise.

(c) (*2 points*) Critique each statement.

ANSWER:

14. QFI PM Spring 2024, Question 13

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4

Company ABC is the plan sponsor for a non-contributory defined benefit pension plan.

The asset management of the pension fund, outsourced to a third-party manager, is invested in government bonds and collateralized loan obligations (CLO). The investment in high-rated CLO was justified to match the retirement liability payments that have duration of about 20 years at the time of retirement.

The pension committee has expressed concern about the credit risk surrounding their investments with the growing number of new retirees.

(a) Describe the exposure to credit risk and the source of credit risk for each party involved in the pension plan.

ANSWER:

The investment policy uses ratings from major rating agencies for its credit risk limits for all fixed income instruments.

(b) Explain three drawbacks of relying on these ratings.

ANSWER:

To mitigate its risk exposure to asset default, ABC is considering entering into a contract with an insurance company. The contract pays the pension fund an income equal to the benefits of the members covered in exchange for a lump sum.

(c) Describe the credit risk exposure created by the above contract for ABC.

ANSWER:

15. QFI PM Fall 2024, Question 6

Learning Outcome(s): 1a, 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4; Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021, Ch 22

You just joined a bank that specializes in structuring Non-Agency Residential Mortgage-Backed Securities (RMBS) as a market risk manager.

Your manager expects that interest rates will decrease in the next few years and does not expect collateral credit loss to be a major concern. They recommend utilizing a senior subordination shifting interest structure as an internal credit enhancement structure.

(a) Describe the mechanics of the recommended structure.

ANSWER:

Your intern provides you with a summary of the company's counterparty exposure:

- Gross exposure is the absolute amount at risk and, thus, the worst case scenario
- There is one contract that posted a letter of credit issued by the counterparty's parent as collateral, so we don't have any credit exposure to this counterparty.
- We've provided a revolver to some of our borrowers in the auto industry but they've never used it, so we should adjust the exposure to reflect the actual historical usage.

(b) Critique each of the above statements.

ANSWER:

(c) Describe the most commonly used methodology to assign a default probability to a counterparty.

ANSWER:

You are concerned about interest rates falling and enter into a 5-year, $100M notional interest rate swap to manage the duration. The agreement specifies that you will pay a floating rate of SOFR + 100 bps per annum and the counterparty will pay you a fixed rate of 4%, with annual payments. At the end of the 3rd year, your counterparty goes bankrupt.

Your intern remarks that this simply means that the swap is terminated, there is no further settlement to consider, and we are lucky that we did not have any financial loss from this transaction.

(d) Assess your intern's statement.

ANSWER:

16. QFI IRM Fall 2023, Question 3

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1 - 4

ABC company has a portfolio consisting of two bonds with exposures, $C_1 = 10$ and $C_2 = 20$.

Their default probabilities are estimated to be $P_1 = 0.2$ and $P_2 = 0.1$.

You are asked to develop a credit-risk model for modeling the default loss of the portfolio:

$L = c_1\, \mathbb{I}_{\mathcal{D}_1} + c_2 \mathbb{I}_{\mathcal{D}_2}$,

where $\mathbb{I}_{\mathcal{D}_i}$ is the default indicator which is equal to one if the ith bond defaults before time T, $i = 1,2$.

Assume that $\mathbb{I}_{\mathcal{D}_1}$ and $\mathbb{I}_{\mathcal{D}_2}$ are independent

(a) (*1 point*) Calculate the 97.5% VaR of L.

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

After your manager reviewed your model, a concern was raised over the independence assumed between the default events. She recommends you use the threshold approach to model the default dependence. Specifically, for $i = 1,2$, let y_i be the state variable underlying the ith bond, which admits the following form:

$y_i = \sqrt{\rho}\, G + \sqrt{1-\rho}\, \epsilon_i$,

where G and ϵ_i are independently distributed standard normal. The state variables are connected to default events via

$$\begin{cases} \mathbb{I}_{\mathcal{D}_i} = 1, & if\ y_i \le \Phi^{-1}(p_i), \\ \mathbb{I}_{\mathcal{D}_i} = 0, & if\ y_i > \Phi^{-1}(p_i). \end{cases}$$

The following table outlines the bivariate standard normal CDF $\Phi_2(x, y; \rho = 0.5)$ evaluated at various points (x, y).

x	y	$\Phi_2(x, y; \rho = 0.5)$
-0.84162	-1.28155	0.05150
0.84162	-1.28155	0.09737
-0.84162	1.28155	0.19737
0.84162	1.28155	0.75150

(a) (*2 points*) Recalculate the 97.5% VaR of L, using the threshold model approach.

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

(c) (*1 point*) Describe the difference between the VaR values based on the independence model and the threshold model.

ANSWER:

17. QFI IRM Spring 2024, Question 4

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1 - 4

To assess credit risk associated with a portfolio consisting of bonds issued by two companies, A and B, you have been tasked with investigating the probability distribution for the number of defaults:

$N = \mathbb{I}_A + \mathbb{I}_B$

where $\mathbb{I}_A$ and $\mathbb{I}_B$ represent the default indicators, taking the value of one if the corresponding company defaults before a specific time T.

Initially, you assumed that the defaults of the companies are independent. After your manager reviewed your model, a concern was raised over the independence assumed among the default events.

(a) Describe two reasons why default events are not expected to be independent.

ANSWER:

Your manager recommends using a binomial-mixture model to address the lack of independence. Specifically, she suggests making the default probability dependent on a common latent random variable Z distributed uniformly over the interval (0, 1).

Moreover, defaults are assumed to be conditionally independent given Z. The conditional default probability for each company is given:

$\mathrm{P}(\mathbb{I}_{\mathrm{i}} = 1|Z) = 1 - Z, \;\; i = A, B.$

(b) Calculate the probability of experiencing one or more defaults within the portfolio under the binomial-mixture model.

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

(c) Calculate the covariance $Cov\ (\mathbb{I}_A, \mathbb{I}_B)$.

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

Next, your manager asks you to use the covariance obtained in part (c) to explain the impact of dependence on the calculation of non-zero default probability.

(d) Describe the difference between the probability of non-zero default obtained from the independence and binomial-mixture models.

ANSWER: