

Exam QFIPM

Date: Thursday, October 28, 2021

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 17 questions numbered 1 through 17 with a total of 100 points.

The points for each question are indicated at the beginning of the question.
2. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions provided in this document.

Written-Answer Instructions

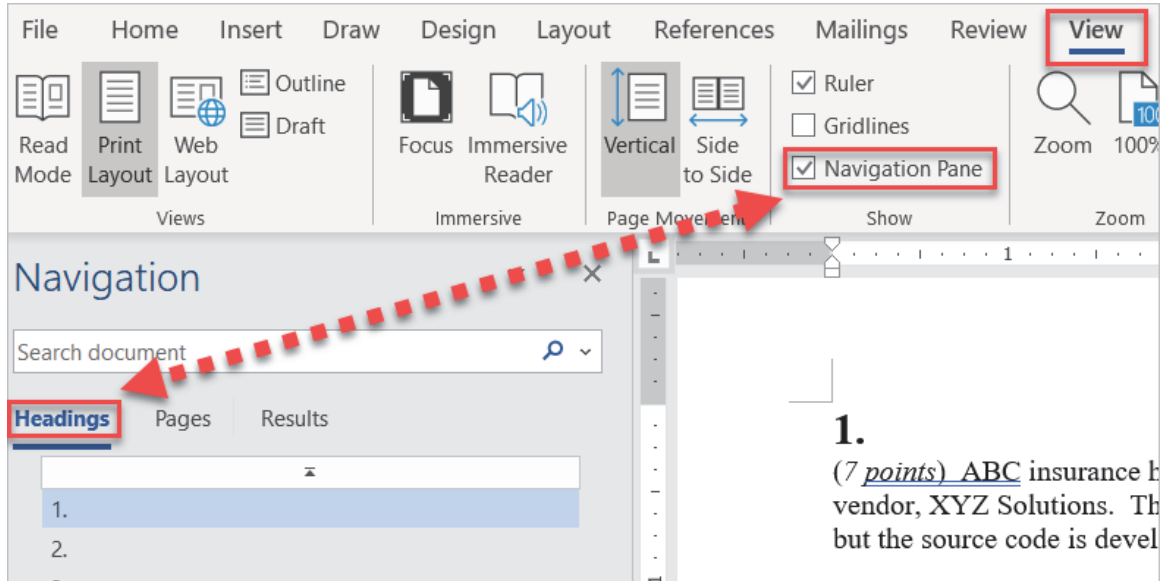
1. Each question part or subpart should be answered either in the Word document or the Excel file as directed. Graders will only look at work in the indicated file.
 - a) In the Word document, answers should be entered in the box marked ANSWER. The box will expand as lines of text are added. There is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

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Navigation Instructions

Open the Navigation Pane to jump to questions.

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



1.

(6 points) 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) (1 point) 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) (2 points) 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) (1 point) Assess the appropriateness of calculating returns using each of the methods listed below:

- (i) Time-weighted rate of return

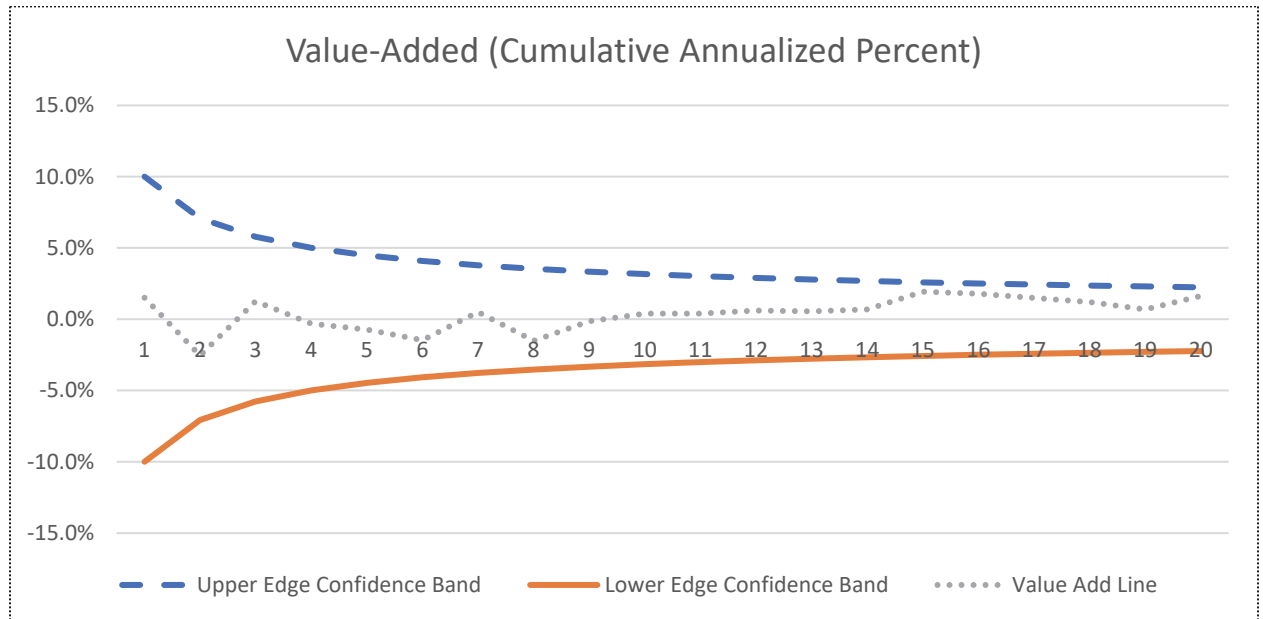
ANSWER:

- (ii) Dollar-weighted rate of return

ANSWER:

1. Continued

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) (2 points) Critique your colleague's statement.

ANSWER:

2.

(5 points) 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) (1.5 points) Calculate the US dollar duration of the portfolio.

ANSWER:

2. Continued

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) (2.5 points) 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) (1 point) Critique the portfolio manager's plan on hedging all currency exposures assuming Interest Rate Parity holds.

ANSWER:

3.

(6 points) In your answer, for expedience, any reasonable presentations of mathematical symbols are acceptable. Some examples are shown below:

sqrt for $\sqrt{\quad}$
e for ε
pn for p_n

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:

$$y_n = \sqrt{\rho_n} G + \sqrt{1 - \rho_n} \varepsilon_n, \quad n = 1, \dots, N$$

$G, \varepsilon_1, \dots, \varepsilon_N$ are independent, identically distributed standard normal random variables

$$0 \leq \rho_n \leq 1$$

- (a) (2 points) Derive the covariance matrix of $[y_1, y_2]$.

ANSWER:

3. Continued

One of your coworkers suggests modelling the latent variables in a different way, as follows:

y_n are latent variables defined by:

$$y_n = \sqrt{\rho}G + \sqrt{1-\rho}\varepsilon_n, \dots n = 1, \dots, N$$

$G, \varepsilon_1, \dots, \varepsilon_N$ are independent, identically distributed standard normal random variables

$$0 \leq \rho \leq 1$$

- (b) (1 point) Explain the implications of using the simplified model your coworker recommends.

ANSWER:

You define a default trigger for your model as follows:

$$\mathbb{I}_{\mathcal{D}_n} \equiv \mathbb{I}_{\{y_n \leq K_n\}} = \begin{cases} 1 & \text{when firm } n \text{ defaults before time } T \\ 0 & \text{otherwise} \end{cases}$$

You are also given:

$$p_n = \mathbb{E}(\mathbb{I}_{\mathcal{D}_n}) , \quad p_{m,n} = \mathbb{E}(\mathbb{I}_{\mathcal{D}_m} \mathbb{I}_{\mathcal{D}_n})$$

- (c) (1 point) Derive an expression for $\rho(\mathbb{I}_{\mathcal{D}_1}, \mathbb{I}_{\mathcal{D}_2})$, the correlation between default variables $\mathbb{I}_{\mathcal{D}_1}$ and $\mathbb{I}_{\mathcal{D}_2}$.

ANSWER:

3. Continued

- (d) (1 point) 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:

$$\mathbb{I}_{\mathcal{D}_n} = \begin{cases} 1 & \text{if } y_n = K_n \\ 0 & \text{if } y_n \neq K_n \end{cases}, n = 1, \dots, N$$

K_n are constant

- (e) (1 point) Explain why it would be inappropriate to use this default trigger as defined by your coworker.

ANSWER:

4.

(6 points) 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) (0.5 points) Define the VC investment strategy.

ANSWER:

- (b) (0.5 points) 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) (1.5 points) Compare and contrast moral hazard and adverse selection with examples.

ANSWER:

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

ANSWER:

4. Continued

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

ANSWER:

5.

(6 points) This question is concerned with convertible arbitrage.

- (a) (1 point) Describe a typical convertible arbitrage strategy and outline the broad steps to implement it.

ANSWER:

You are given the following information about a convertible bond at $t=0$.

Face value	\$1,000
Coupon rate	5%
Market price	\$1,100
Conversion ratio	36.65
Estimated delta (relative to the parity value in dollars)	0.8
Price of the underlying stock	\$25
Dividend yield	1%

- (b) (1 point) Calculate the conversion premium of the convertible bond.

ANSWER:

Suppose you implement the following convertible arbitrage trade. The total capital invested in this trade is \$1,100,000, of which \$200,000 is equity and \$900,000 is borrowed. The cost of borrowing is 2%, and the interest rate on short proceeds is 1%. You close these positions after 1 year (i.e., at $t=1$) by selling the bonds at \$1,150 and buying back the stocks you shorted at \$28.

- (c) (2 points) Calculate the total cash flow of this convertible arbitrage trade.

ANSWER:

5. Continued

- (d) (1 point) Calculate the contribution of leverage of this convertible arbitrage trade.

ANSWER:

- (e) (1 point) Identify four preferable features of convertible bonds or stocks in a convertible arbitrage trade.

ANSWER:

6.

(5 points) You are the manager of your company's pension plan, whose funding ratio has experienced volatility over the last year and is now at 70%. Currently, the portfolio backing the pension liabilities is invested 40% in equity and 60% in a mix of Treasury and corporate bonds.

Your assistant recommends that the plan reposition the portfolio to invest 50% in Treasury bonds and 50% in corporate bonds.

- (a) (1 point) Explain the major benefits and limitations of this proposed allocation.

ANSWER:

- (b) (1 point) Describe derivative securities that will help achieve capital efficient liability hedging that address a plan's interest and inflation risks.

ANSWER:

6. Continued

Three options are being considered to improve the funding ratio of the plan and limit the volatility of the funding ratio. The plan would like to use up to 4 times the leverage.

Option A: Keep the current portfolio and rebalance between equity and bonds based on the correlation and volatility assumptions.

Option B: Invest 100% in bonds but increase equity exposure to 60% using synthetic equity.

Option C: Invest 100% in a pooled LDI fund.

- (c) (2 points) Evaluate each of the three options in order of their ability to achieve the plan's goal.

ANSWER:

The current environment is one in which bond yields have fallen to unprecedented low levels.

- (d) (1 point) Justify the plan's allocation to fixed income given the current environment.

ANSWER:

7.

(6 points) You are an investment actuary at ABC Life, a small life insurance company that specializes in term insurance for active young adults. ABC competes primarily with XYZ Assurance, who also specializes in selling term insurance, although ABC holds a larger share of the market.

The President of ABC, seeking another advantage over XYZ, has expressed interest in expanding ABC's products to include universal life and long-term care. The President seeks out your expertise and informs you during a meeting that they are particularly concerned about being able to manage ABC's liquidity risk.

- (a) (0.5 points) Describe two types of liquidity management concerns.

ANSWER:

The President informs you that their highest priority is ensuring that ABC's liabilities can be met. You learn that ABC has a line of credit with a local bank, and they also shared with you ABC's current asset portfolio consists of the following:

- 40% AA-rated 5-10 year corporate bonds
- 35% 5-year US Treasury bonds
- 20% cash
- 5% private equity

- (b) (1.5 points) Analyze the appropriateness of ABC's current asset portfolio for supporting universal life or long-term care products.

ANSWER:

7. Continued

Although ABC's current term policies do not have cash values, the President still has concerns about rising interest rates and the impact that may have on policy surrenders in the future.

- (c) (1 point) Assess the President's concern about interest rates and early policy surrenders.

ANSWER:

- (d) (1 point) Describe two policy provisions that would address concerns about surrenders.

ANSWER:

During these discussions, ABC learns that XYZ will begin offering both universal life and long-term care products within the next few months. The President insists that a decision on this new product offering must be made immediately.

- (e) (2 points) Recommend whether or not ABC should begin developing these new products.

ANSWER:

8.

(7 points) 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) (1 point) 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) (2 points) 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:

8. Continued

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) (2 points) 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) (1 point) Analyze Manager B's investment style.

ANSWER:

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

- (e) (1 point) Describe four benefits of incorporating ESG criteria in portfolio management.

ANSWER:

9.

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

(a) (1.5 points)

- (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) (2 points) 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) (1.5 points) Explain the course of action the borrower should take in each scenario above.

ANSWER:

10.

(7 points) ABC insurance company issues whole life insurance and long-term care policies and invests in corporate bonds to support these insurance contract liabilities. The duration of its liabilities is significantly greater than the duration of its assets and ABC enters into interest rate swaps to manage this exposure.

ABC also sells variable annuity contracts with minimum death benefit guarantees on the underlying funds. ABC currently utilizes a combination of bonds, equities, and derivatives to hedge the financial risk on this block of business.

ABC is required to adopt IFRS 17 for its insurance contracts and IFRS 9 for its assets. ABC makes an accounting policy choice to disaggregate insurance finance income and expense between profit and loss, and other comprehensive income for the insurance contracts it issues (i.e. ABC elects the OCI option). ABC has a committee that is assessing the categorization of assets under IFRS 9.

ABC classifies its whole life and long-term care policies as insurance contracts without direct participation features and uses the General Measurement Model (GMM). ABC classifies its variable annuity contracts as insurance contracts with direct participation features and uses the Variable Fee Approach (VFA).

ABC is concerned about the income statement volatility that will result from the IFRS 9 measurement of its corporate bonds, depending on its choice of FVPL, FVOCI, or amortized cost.

(a) (2 points) Explain the asset and liability accounting mismatches that ABC could experience for each IFRS 9 measurement choice as it relates to:

(i) The contracts measured using GMM

ANSWER:

(ii) The contracts measured using VFA

ANSWER:

10. Continued

- (b) (1 point) Explain how fair value hedge accounting can reduce the accounting mismatches for ABC's contracts that are measured using GMM.

ANSWER:

- (c) (2 points) Explain how the IFRS 17 risk mitigation option could help reduce the accounting mismatches that ABC will experience on the VFA contracts.

ANSWER:

- (d) (2 points) Explain the respective advantages and limitations of fair value hedge accounting and the IFRS 17 risk mitigation option.

ANSWER:

11.

(5 points) 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:

$$p_n(S) \equiv P(I_{Dn} = 1 | S) = p_n(\omega_0 + \omega_1 S)$$

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:

11. Continued

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 $\Gamma(a=0.01, b=0.01)$. 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) (2 points) 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) (1 point) Describe critical assumptions that are needed for the multi-factor version of the model.

ANSWER:

12.

(6 points) 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) (1 point) Define the following:

(i) Efficient Portfolio

ANSWER:

(ii) Global Minimum Variance Portfolio

ANSWER:

(iii) Tangency Portfolio

ANSWER:

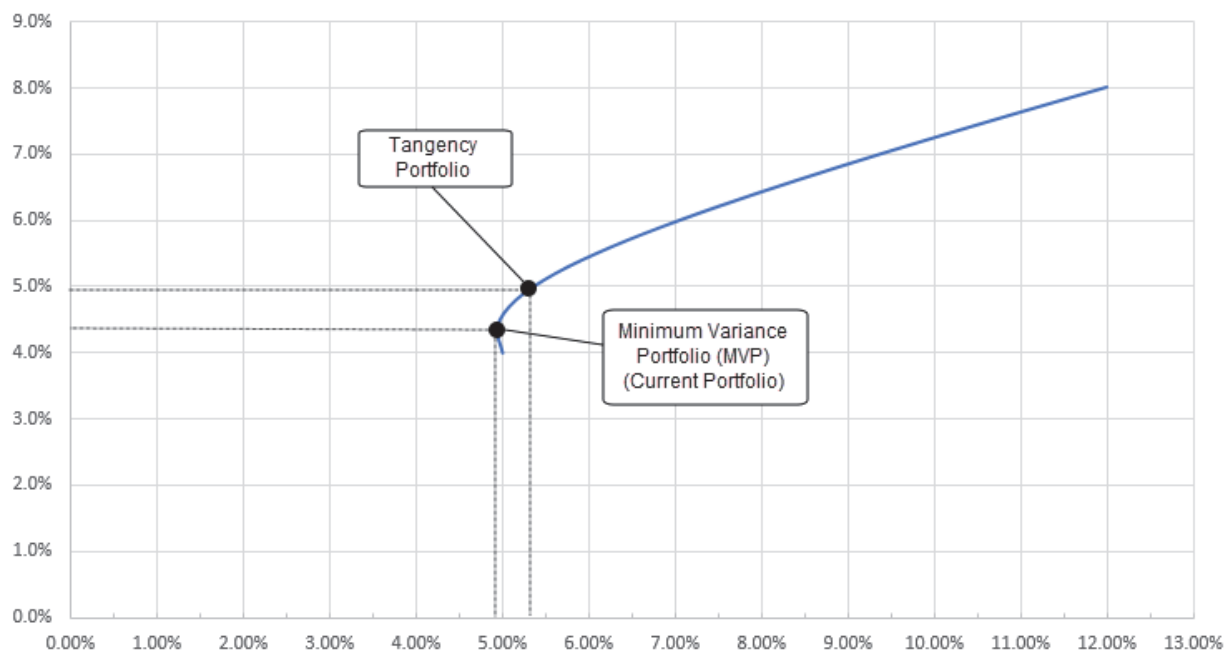
(iv) Capital Allocation Line

ANSWER:

12. Continued

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%

12. Continued

- (b) (1 point) 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) (2 points)

- (i) (0.5 points) Explain why your manager is incorrect.

ANSWER:

- (ii) (1.5 points) 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:

12. Continued

(d) (2 points)

- (i) (0.5 points) 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) (1.5 points) 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.

(7 points) 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) (1 point) Describe four reasons why an Investment policy statement (IPS) is important to ABC's pension plan.

ANSWER:

- (b) (1 point) 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) (1 point) Critique this suggestion.

ANSWER:

- (d) (1 point) Explain how an IPS is used for investment risk management of a DC plan.

ANSWER:

13. Continued

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) (3 points) 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.

(5 points) ABC life insurance currently owns a \$150 million TIPS portfolio with an average yield of 3% (semi-annual), all bought at par value on April 1 of this year.

Assume today is April 2nd of this year.

ABC expects to receive three coupon payments on April 10, July 10, and October 10 of this year.

The economic forecasting unit has the following projection on this year's economic scenario. Inflation is expected to be steady at 2.25% per year with an inflation risk premium of 0.5%.

	Jan 1	Feb 1	Mar 1	Apr 1	May 1	Jun 1	Jul 1	Aug 1	Sep 1	Oct 1	Nov 1	Dec 1
CPI-U	250	255	258	256	262	270	275	274	280	282	288	290
Nominal Yields	3.5%	3.9	4.1	4.3	4.2	4.0	3.9	2.8	3.7	3.8	3.85	2.8

- (a) (1.5 points) Calculate the expected principal levels of the TIPS portfolio at the 3 payment dates.

ANSWER:

- (b) (1 point) Calculate the total of all three expected coupon payments.

ANSWER:

You subtract the inflation risk premium from the nominal yield.

- (c) (1 point) Calculate the breakeven inflation rate for the April payment

ANSWER:

14. Continued

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

- (d) (1.5 points) Describe three purposes that common covenants in a leveraged loan obligation serve.

ANSWER:

15.

(6 points) You recently joined a US-based life insurance company as the head of infrastructure investments. Leveraging prior experience in managing multiple healthcare and transportation infrastructure funds in North America, you are to build a dedicated investment team to manage infrastructure assets backing long-dated liabilities. Currently, only a small proportion of the portfolio is allocated to infrastructure, with the rest consisting of equity and fixed income assets.

(a) (1 point) Explain why the following characteristics of infrastructure investments are desirable for your portfolio:

(i) Resilience to economic downturns

ANSWER:

(ii) Inflation indexing

ANSWER:

There is substantial opportunity in infrastructure investment. The market for private investment in infrastructure is expected to continue to grow.

(b) (2 points) Explain the reasons for this growing opportunity, centering your discussion around each of the following factors:

(i) Demand for infrastructure investment

ANSWER:

(ii) Role of government & public-private partnership (PPP)

ANSWER:

15. Continued

You have identified two investment opportunities and presented the following summary to senior management.

Name	Infra-X	Infra-Y
Description	Investments in Canadian infrastructure equity market, specializing in greenfield hospital projects	Brownfield investments in power plants located in Vietnam, utilizing cutting edge technology
Stage	Greenfield / construction period	Brownfield / operation period
Location	Canada	Vietnam
Sector	Hospital	Energy
Operating history	None – under construction, with average term to completion of 2 years	1 year

You received the following feedback:

- Go for lower risk investments, even if it means lower return potential.
 - Avoid risks that are harder to quantify such as environmental, legal, and political.
 - Leverage company expertise.
- (c) (2 points) Recommend one of the two investment opportunities based on the following criteria:
- Stage of maturity
 - Geographical location
 - Sector scope

ANSWER:

Your long-term goal is to access infrastructure exposure through direct deals.

- (d) (1 point) Describe the talents needed for successful direct investment in infrastructure.

ANSWER:

16.

(5 points) You recently invested in a corporate bond with a face amount of \$1,000 maturing in one year. There are no coupon payments. You are given that the one-year risk-free rate is equal to zero. Based on the financial strength of the company, you estimate that there is a 1% chance the company will not be able to repay their debts. If that happens, you estimate that you will only get half of your money back. The current market price of the bond is \$980.

(a) (1 point) Calculate each of the following for this bond:

(i) risk-neutral probability of default;

ANSWER:

(ii) real-world probability of default; and

ANSWER:

(iii) credit risk premium.

ANSWER:

(b) (1 point) Describe one advantage and one disadvantage of using risk-neutral probabilities in credit risk management.

ANSWER:

(c) (1.5 points) Describe a process for selecting the appropriate market information to use in determining credit spreads for any counterparty.

ANSWER:

16. Continued

You find that there is a liquid credit default swap (CDS) for the company that issued your bond; however, you observe that the credit spread estimated from the CDS is not the same as the actual spread on the bond.

- (d) (1.5 points) Explain four reasons why these spreads may differ.

ANSWER:

17.

(7 points) You are hired to manage a small defined benefit plan for company XYZ. Company XYZ offers a lifetime pension to its employees who are relatively young. Your goal is to meet the strategic asset allocation (SAA) objective of the pension plan and to minimize unrewarded risks.

- (a) (1 point) Identify four strategic asset allocation concerns for the pension plan.

ANSWER:

- (b) (1 point) Explain unrewarded risks and how they impact the value of the pension plan.

ANSWER:

XYZ's management is very concerned about future financial stability and implements an LDI strategy to mitigate the unrewarded risk and other risks using bonds and swaps.

- (c) (2 points) Justify the decision of using an LDI strategy.

ANSWER:

17. Continued

Management asks for a simple example of how this will work to hedge the liabilities through the use of two investment tools:

- (i) A bond.
- (ii) Cash and using swaps.

Assume the following:

- A single pension payment of \$100M to be made in 1 year.
 - Current interest rate is 3% per year.
 - A 1 year swap paying floating (in effect at $t > 0$) receiving fixed at a rate of 3% (payments made annually at end of year).
 - Cash is invested at the floating rate in effect at $t > 0$.
 - Notional amount of swap equals the present value of liabilities prior to any interest rate shock.
 - Initial liability is valued and swap is purchased prior to any interest rate shock.
- (d) (2 points) Evaluate the appropriateness of these two investment tools to hedge the liabilities through the use of +100 bps and -100 bps shocks at $t=0$.

ANSWER:

After presenting your idea to the CFO of the company, the CFO of Company XYZ suggests that you consider the current low interest rate environment and switch to holding more cash or cash equivalents instead of bonds as he has concerns about the potential of negative bond yields in the future even though the yield curve is upward sloping.

- (e) (1 point) Critique the appropriateness of the CFO's suggestion.

ANSWER:

****END OF EXAMINATION****