

QFI PM Model Solutions

Fall 2020

1. Learning Objectives:

6. The candidate will understand:
- Investment dimensions of designing product offerings and managing inforce product liabilities.
 - Managing investment portfolios in the context of financial institution liabilities (asset liability management).
 - The theory and techniques of portfolio asset allocation.

Learning Outcomes:

- (6a) Demonstrate an understanding of how the behavioral characteristics of individuals and firms influence liability design, management, and ALM
- (6b) Develop and critique asset allocation strategies appropriate to underlying liability profiles such as pension plans and long tail insurance liabilities
- (6c) Evaluate the difficulties of investing for long tail liabilities (i.e. beyond 30 years) such as inflation indexed pension plans and secondary guarantee universal life insurance

Sources:

QFIP 142-19 Ch 10

MIP Chapter 5.9 SAA for Institutional Investors

Commentary on Question:

This question tests the concepts and applications of asset liability management for a pension plan, with a focus on numerical calculations. Candidates performed well in the calculation questions but performed poorly on parts that require deeper comprehension. Candidates were particularly unsuccessful in retrieving the appropriate formula in part (f), which was required to receive full credit. Overall, candidates performed as expected on this question.

Solution:

- (a) Calculate the expected return of the pension liabilities as of December 31st, 2019.

Commentary on Question:

Candidates performed as expected on this question. Successful candidates were able to identify the appropriate formula and calculate the correct answer.

1. Continued

$$R_{L,t} = R_{f,t} + \beta(R_{B,t} - R_{f,t}) + \varepsilon_t$$
$$E(R_{L,t}) = 1.5\% + \frac{\text{Liability duration}}{\text{Proxy bond duration}} (5\% - 1.5\%)$$
$$E(R_{L,t}) = 1.5\% + \frac{12}{11.5} (5\% - 1.5\%)$$
$$E(R_{L,t}) = 5.15\%$$

- (b) Explain sources of uncertainty in pension liabilities captured by the term ε_t .

Commentary on Question:

Candidates performed poorly on this question. Candidates that identified, explained and described the directionality of the risk performed well on this question. All three risks were required to receive full credit. Candidates that referenced asset-related risks received no credit on this question, despite correctly listing liability-related risks.

- Mortality rates, where life expectancy may increase due to trends in lifestyle and/or healthcare
- Future salary growth, where the actual salary growth is higher than expected or one-time benefit increases are applied
- Employee demographics, where the demographics of the retired population differ from expected, e.g. a company may offer incentives for early retirement or is obligated to terminate a portion of the workforce

- (c) Describe the least risky investment strategy to fund the pension liability.

Commentary on Question:

Candidates performed below average on this question. Many candidates recommended investments in equities even though the question asked for the least risky investment strategy. Many candidates failed to completely answer the question by not describing the treatment of surplus assets.

The least risky strategy would be to:

- Purchase portfolio of bonds that represent the best guess about future liabilities
- Invest the remainder (surplus) in risk-free asset

1. Continued

- (d) Determine the strategy's expected surplus volatility.

Commentary on Question:

Candidates did poorly on this question. Unsuccessful candidates did not recognize the relationship between expected surplus volatility and the noise term.

The expected surplus volatility is 2%, the annual standard deviation of the noise term.

- (e) Calculate the following as of December 31st, 2019:
- (i) The expected funding ratio on December 31st, 2020, using a return on surplus $R_x = 1.85\%$
- (ii) The maximum payout structure p that the pension fund can sustain in year 2020 while maintaining its current funding ratio on December 31st, 2020.

Commentary on Question:

Candidates performed as expected on this question. Unsuccessful candidates listed the correct answer without showing their work.

- (i) The expected funding ratio at the end of the first year is determined using formula 10.A.22 provided:

$$E_0(F_t) = \left(\frac{1 + \mu_x}{1 - p}\right)^t F_0 + p \frac{1 - \left(\frac{1 + \mu_x}{1 - p}\right)^t}{\mu_x + p}$$

$$E_0(F_1) = \left(\frac{1 + R_x}{1 - p}\right) F_0 + p \frac{1 - \frac{1 + R_x}{1 - p}}{R_x + p}$$

$$E_0(F_1) = \left(\frac{1.0185}{1 - 0}\right) 0.9 + (0) \frac{1 - \frac{1.0185}{1 - 0}}{.085 + 0}$$

$$E_0(F_1) = 1.0185(0.9) = 0.91665$$

Or formula 10.A.17:

$$F_1 = \frac{1}{1 - p} F_0 (1 + R_x) - \frac{p}{1 - p}$$

$$F_1 = \frac{1}{1 - 0} (0.9)(1.0185) - \frac{0}{1 - 0} = (0.9)(1.0185) = 0.91665$$

1. Continued

- (ii) The maximum payout structure p that the fund can sustain while maintaining the current funding ratio a year from today is also determined using the formula 10.A.17 provided, where p is solved for such that $F_1 = 0.9$.

$$F_1 = \frac{1}{1-p} F_0(1 + R_x) - \frac{p}{1-p}$$

$$0.9 = \frac{1}{1-p} (0.9)(1.0185) - \frac{p}{1-p}$$

$$0.9 = \frac{0.91665 - p}{1-p}$$

$$0.9 - 0.9p = 0.91665 - p$$

$$0.1p = 0.01665$$

$$p = 16.65\%$$

- (f) Estimate the expected percentage change in the liability value one month from today under the above scenario.

Commentary on Question:

Candidates performed poorly on this question with many not receiving full credit. A number of candidates arrived at a value that was close through other estimation methods; however, in order to receive full credit the use of the formula was required.

Formula 10.A.4 should be used to arrive to a 7.12% increase in the value of the liabilities.

$$\frac{dV}{V} = \frac{dC}{C} - (T - t)dr + rdt$$

$$\frac{dV}{V} = .05 - \left(20 - \frac{1}{12}\right)(-.0010) + (.015)\frac{1}{12}$$

$$\frac{dV}{V} = .071167$$

1. Continued

- (g) Compare and contrast the managing of a defined benefit pension plan vs. a life insurance fund.

Commentary on Question:

Candidates performed above average on this question. Successful candidates clearly explained at least two similarities and at least two differences in managing a defined benefit pension plan versus a life insurance fund. Candidates that focused on only similarities or differences received partial credits.

Candidates received no credit for statements that were not generally accepted to be true.

- Differences
 - Insurers are taxable
 - Portfolio segmentation is a distinctive feature of life insurers
- Similarities:
 - Both a long-term liabilities
 - Both typically use an ALM approach to SAA
 - ALM considerations include yield, duration, convexity, key rate sensitivity, value at risk, and the effects of asset risk on capital requirements
 - Both face contractual liabilities to insureds

2. Learning Objectives:

1. The candidate will understand how to work with the variety of fixed income instruments and evaluate fixed income portfolios.

Learning Outcomes:

- (1c) Demonstrate an understanding of the cash flow patterns and risks of whole loan commercial mortgages

Sources:

Miller & Geltner, Commercial Real Estate Analysis and Investments, 3rd Edition, Chapter 16, 19, 20

Commentary on Question:

This question tests the concept of commercial mortgages and the understanding of cash flow patterns of commercial mortgage-backed securities.

Solution:

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

Commentary on Question:

The candidates performed as expected on this section. A few candidates identified permanent and construction loans and correctly listed out the differences in terms of duration, default risk, and interest rate risk. Some candidates received the partial credits, as they were able to describe the loan types and compared the differences without correctly identifying the loan types.

Permanent loans and construction loans are the two main types of commercial mortgages.

- Permanent loans have higher interest rate risk than construction loans.
- Construction loans have higher default risk than permanent loans.
- Construction loans are short-term loans, while permanent loans are long-term loans.

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

- (i) Loan-to-Value ratio
- (ii) Weighted Average Maturity

Commentary on Question:

The candidates performed above average on this section. Most candidates correctly calculated LTV ratio and Weighted Average Maturity and then made correct recommendation based on the results. However, many candidates failed to explain that the CMBS-I's WAM better fits the XYZ's liability profile.

2. Continued

(i) Loan-to-Value ratio (LTV):

- LTV for CMBS-I = $(\$200M + \$50M) / \$400M = 0.625$
- LTV for CMBS-II = $(\$220M + \$80M) / \$450M = 0.667$

From the LTV perspective, CMBS-I is preferred as it has a lower LTV ratio.

(ii) Weighted Average Maturity (WAM):

- WAM for CMBS-I = $(4 \text{ years} * 2 * \$50M + 6 \text{ years} * 3 * \$50M) / \$250M = 5.2 \text{ years}$
- WAM for CMBS-II = $(7 \text{ years} * 1 * \$100M + 10 \text{ years} * 2 * \$100M) / \$300M = 9 \text{ years}$

From the WAM perspective, CMBS-I is preferred given XYZ's substantial liability payments in 6 years.

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

Commentary on Question:

The candidates performed as expected on this section. A few candidates correctly calculated the par value of both mortgage pool and tranche A and then derived the subordination in either percentage or dollar value term. Some candidates received partial credit by describing or showing the formula for subordination.

At the beginning of Year 5:

- Mortgage pool par value = $\$250M - 2 * \$50M = \$150M$
- Tranche A par value = $\$200M - 2 * \$50M = \$100M$
- Subordination = $(\$150M - \$100M) / \$150M = 0.33$ or
Subordination = $\$150M - \$100M = \$50M$

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

Commentary on Question:

Candidates performed below average on this section. Many candidates only received small partial credits by identifying the holding period return for plan B and recommending the plan with the higher return based on their calculation. Most of them didn't calculate the holding period return of plan A and compared the dollar returns for their recommendation. A few candidates were able to describe how the cash flows through the tranche structure under scenario 1 and recognized that XYZ receives 50% of cash flow received by tranche A. But they failed to calculate the correct interest rate on underlying mortgages, nor the final cash received by the tranche A.

2. Continued

Plan A

Scenario 1:

Interest rate on underlying mortgages =

$$(5\% * \$200M + 8\% * \$50M + 1.4\% * \$250M) / \$250M = 7\%$$

or

$$(5\% * \$100M + 8\% * \$50M + 1\% * \$150M) / \$150M = 7\%$$

Cash flow received by servicer

= Principal + Interest on non-defaulted loan + Recovered amount on defaulted loans

$$= \$50M * 1.07 + \$45M = \$98.5M$$

Cash flow received is first used to pay interest, then to Tranche A and finally to Tranche B.

- Cash flow received by Tranche A = $\$98.5M - 8\% * \$50M - 1\% * \$150M = \$93M$
- Cash flow received by XYZ = $50\% * \$93M = \$46.5M$

Scenario 2:

$$\text{Coupon payment} = \$50M * 5\% = \$2.5M$$

$$\text{Principal payment} = \$50M$$

$$\text{Total cash flow} = \$2.5M + \$50M = \$52.5M$$

$$\text{Expected cash flow} = \$46.5M * 60\% + \$52.5M * 40\% = \$48.9M$$

Calculate XYZ's expected Holding Period Return in Year 6 under Plan A.

$$r_{EOY} = (CF_{EOY} + V_{EOY} - V_{BOY}) / V_{BOY}$$

EOY stands for End of Year, and BOY stands for Beginning of Year.

$$= (\$48.9M + 0 - \$48M) / \$48M$$

$$= 1.88\%$$

Plan B

The expected Holding Period Return is 2.5%.

Recommendation:

Plan B is recommended as it has a higher Holding Period Return in Year 6.

3. Learning Objectives:

1. The candidate will understand how to work with the variety of fixed income instruments and evaluate fixed income portfolios.

Learning Outcomes:

- (1a) Describe the cash flow of various fixed income securities considering underlying risks such as interest rate, credit and event risks
- (1b) Demonstrate an understanding of common techniques to enhance yield and manage liquidity in fixed income portfolios

Sources:

Handbook of Fixed Income Securities, Fabozzi, F.J., 8th Edition, 2012 Chapter 13 pg 289-296

Handbook of Fixed Income Securities, Fabozzi, F.J., 8th Edition, 2012 Chapter 35 pgs 737-41

QFIP-135-19: High-Yield Bond Market Primer

Commentary on Question:

This question tests the candidate's understanding of the characteristics of leveraged loans, CLOs, and high yield bonds.

The candidates performed as expected on this question.

Solution:

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

Commentary on Question:

The candidates performed as expected on this question. Successful candidates described the characteristics of Assignment and Participation, how they affect the borrower and buyer, and provided a recommendation that was supported with solid arguments.

Assignment – Selling a loan through assignment transfers the ownership of the debt to the buyer, and the buyer becomes the lender of record. Borrower needs to approve this transaction.

Participation – Selling a loan through participation does not transfer the ownership, lender of record remains with the original lender. This creates additional credit risk to buyer and cannot achieve best price.

Recommend selling via assignment because both company ABC and the prospective buyers are on good terms with the borrowers. Borrower would give consent to the transfer of the ownership and ABC can achieve best pricing.

3. Continued

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

Commentary on Question:

The candidates performed as expected on this question. Successful candidates explained the benefit of the CLO from company ABC's perspective.

The CIO believes the regulatory required capital for leveraged loans is too high. By selling the loans to the CLO, Company ABC can remove them from balance sheet and reduces the required regulatory capital.

Since ABC already has expertise in leveraged loans, by packaging loans into CLO, ABC can earn additional asset management fees.

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

Commentary on Question:

The candidates performed below average on this question. Unsuccessful candidates failed to recall the CLO being a bankruptcy remote entity. Successful candidates were able to explain the waterfall structure and how the absolute priority rule is violated in the context of loans and bonds.

We disagree with the colleague's statement.

The equity tranche is at the bottom of the CLO's capital structure. The absolute priority rule is often violated in practice, in the context of loans and bonds, which results in junior claims getting some payment before senior claims are paid in full. However, CLO is a bankruptcy remote entity, so it cannot be bankrupt. The absolute priority rule will not be violated for a CLO. The CLO's cash flow waterfall ensures senior creditors will be paid before junior creditors.

- (d) 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

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

3. Continued

Commentary on Question:

The candidates performed below average on this question. Successful candidates correctly described each characteristic and explained how they will address the CIO's concern when financial conditions deteriorate. Unsuccessful candidates focused on the issuer of the bonds instead, or confused put provision and call protection with a put option and call option.

Put Provision – Put provision allows the bondholder (Company ABC) to accelerate the repayment of debt at a pre-defined price. This could address CIO's concern when financial condition of the borrower deteriorates.

Call Protection – Call protection limits the ability of the borrower to call the paper for redemption for a period of time. This would provide little value if the borrower's position deteriorated, since the borrower would be unlikely to exercise the call.

Bullet Structure – A bullet structure provides call protection for the entire term of the bond. This would provide little value if the borrower's position deteriorated, since the borrower would be unlikely to exercise the call.

Equity Warrants – An equity warrant allows the bondholder to purchase equity at a future date. This would provide little value since the ability to buy equity in the borrower is not valuable if the borrower's position deteriorated.

(e)

- (i) Assess whether each of the three asset classes is appropriate in the context of each the above statements.
- (ii) Recommend one of the above three asset classes.

Commentary on Question:

The candidates performed above average on this question. Successful candidates compared and contrasted all three assets for each statement, and made suggestions backed by solid reasoning.

Statement I

Senior Tranche CLO

Senior Tranche CLO offers less credit risk exposure due to the structuring of the CLO. This asset class offers less credit risk exposure than high yield bonds or leveraged loans.

Leveraged Loans

Leveraged loans are issued by counterparties that are below-investment grade, offer more credit exposure than Senior Tranche CLO.

High Yield Bonds

High yield bonds offer more credit exposure than leveraged loans since they are lower on the priority.

3. Continued

Statement II

Senior Tranche CLO

In a CLO, principal will be paid to senior tranches first. Thus, senior tranche will have a shorter maturity than the other asset classes.

Leveraged Loans

Leveraged loans consist of term loans between 3 and 7 years with a floating rate component.

High Yield Bonds

High yield bonds will typically mature between 7 and 10 years, with a fixed rate component.

Statement III

Senior Tranche CLO

Senior tranche CLO is exposed to less credit risk, and has no potential of bankruptcy since CLO is a bankruptcy remote entity.

Leveraged Loans

Leveraged loans recovery rate is often higher than high yield bonds when facing bankruptcy.

High Yield Bonds

High yield bonds are exposed to high risk of bankruptcy due to low credit ratings issues.

High Yield Bonds are recommended because:

High yield bonds have the most credit risk exposure of the three instruments.

High yield bonds have the longest maturities and are more likely to be fixed rate.

These characteristics make high yield bonds a better match to liabilities.

The company can utilize its competitive advantage in bankruptcy negotiation to achieve a violation of the priority rule, demanding a higher than expected recovery rate.

4. Learning Objectives:

2. The candidate will understand:
 - The credit risk of fixed income portfolios, securities, and sectors and be able to apply a variety of credit risk theories and models.
 - How rating agencies rate corporate and sovereign bonds.

Learning Outcomes:

- (2a) Demonstrate an understanding of credit risk analysis and models

Sources:

Bouteille, Handbook of Credit Risk Management, Chapter 5

Commentary on Question:

This question tests whether the candidate understands the concept of dynamic credit exposure and the use of statistical analysis to assign an exposure amount to the dynamic credit risk.

Solution:

- (a) Describe the dynamic credit exposure created by this transaction for each of the two swap counterparties.

Commentary on Question:

The candidates performed above average on this section.

Most candidates were able to demonstrate understanding of the dynamic exposure and calculating the MTM value. However, many missed the fact that the exposure is a credit exposure because of the possibility of default by either party.

- By entering into the transaction, there is a possibility that either party can lose money if the other party defaults.
 - Dynamic credit exposure is a credit exposure that is not fixed, but fluctuates with the value of an underlying product on which the financial arrangement is based.
 - The exposure of each party is dependent on the 1 year LIBOR at the end of the year. This is not known upfront and there is therefore dynamic credit exposure as time progresses from inception to maturity, and as the value of LIBOR changes.
- (b) Determine a value of LIBOR at the end of the year which results in positive credit exposure from this transaction, for each of:
 - (i) B Corp
 - (ii) L Bank

Commentary on Question:

The candidates performed above average on this section.

4. Continued

- (i) At the end of the year, if the LIBOR is greater than 3% then B Corp has positive credit exposure of $100m * (LIBOR + 1\% - 4\%) > 0$; e.g. 4%
- (ii) At the end of the year, if the LIBOR is less than 3% then then L Bank has credit exposure of $100m * (4\% - 1\% - LIBOR) > 0$; e.g. 2%
- (c) Calculate the resulting credit exposure for each party at the end of the year, under each of the two LIBOR values determined in part (b), to complete the table below:

	End-of-Year Credit Exposure	
Party	LIBOR from b(i)	LIBOR from b(ii)
B Corp		
L Bank		

Commentary on Question:

The candidates performed above average on this section.

Many candidates did not recognize that if the MTM is negative then the exposure is 0.

	End-of-Year Credit Exposure	
Party	LIBOR from b(i)	LIBOR from b(ii)
B Corp	$100M * (4\% + 1\% - 4\%) = 1M$	0
L Bank	0	$100M * (4\% - 1\% - 2\%) = 1M$

- (d) Describe in words a graph for the probability density for L Bank’s MTM value for this transaction, covering the following elements:
 - (i) Description of the x (horizontal) and y (vertical) axes
 - (ii) Interpretation of the area below the curve
 - (iii) Description of general shape that might be expected
 - (iv) Explanation of where L Bank’s gross exposure (VaR at 99.5%) would lie on that graph, and
 - (v) Explanation of where higher and lower LIBOR rates would be represented on the graph

4. Continued

Commentary on Question:

The candidates performed as expected on this section.

A few candidates identified the asymmetric shape of the pdf; on the assumption that LIBOR is unlikely to be < 0 , then L bank has positive MTM when LIBOR is between 0 and 3% and negative MTM when LIBOR is greater than 3%. However, recognizing this was not necessary to earn full credit.

- (i) MTM value on x axis, probability on y axis; LIBOR could also be used as x axis
 - (ii) area below the curve represents (cumulative) probability that MTM value is at or below given level
 - (iii) general shape of normal distribution might be expected, higher level of curve near middle, much lower level at left and right (tail) extremes; Or skewed distribution due to asymmetric nature of credit exposure for L Bank
 - (iv) gross exposure (VaR 99.5) would lie close to right end of graph such most (99.5%) of curve area lies to the left
 - (v) L Bank receives fixed so is exposed to lower rates (from b,c) so LIBOR could be added on x axis with higher rates (lower MTM) on left of graph, and lower rates (higher MTM) on right of graph. 99.5% VaR would correspond to a very low level of LIBOR.
- (e) Outline reasons why L Bank might want to consider using VaR at 99% instead of VaR at 99.5% for determining its gross exposure amount.

Commentary on Question:

The candidates performed as expected on this section.

A few candidates recognized that the two metrics would give similar values in this particular case i.e. $VaR_{99} \sim VaR_{99.5} \sim \$3M$ assuming $LIBOR > 0$.

Risk managers have to choose a confidence interval / level that fits their firm's risk appetite. The exposure based on VaR 99.5 will be higher and more conservative than that based on VaR 99 and will consume more of the credit capacity allocated to the counterparty. This creates opportunity costs since other profitable transactions would be rejected due to lack of available credit capacity on the same counterparty, whereas the likelihood of reaching the high credit exposure with the derivative transaction is small. In actual practice, many financial institutions set the confidence interval at 99 percent (corresponding to a 1 percent chance of experiencing losses beyond this point).

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 - The theory and techniques of portfolio asset allocation.

Learning Outcomes:

- (6a) Demonstrate an understanding of how the behavioral characteristics of individuals and firms influence liability design, management, and ALM
- (6b) Develop and critique asset allocation strategies appropriate to underlying liability profiles such as pension plans and long tail insurance liabilities

Sources:

QFIP-152-20: How Behavioral Biases Affect Finance Professionals
Managing Investment Portfolios: A Dynamic Process, Maginn & Tuttle, 3rd Edition, 2007, Chapter 7.7

Commentary on Question:

This question tests the understanding of behavior biases displayed by finance professionals in portfolio management decisions. Overall, the candidates performed as expected on this question.

Solution:

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

Commentary on Question:

The candidates performed as expected. Answers that correctly identified the biases, provided correct descriptions, and related the biases to the context presented received full credit. Candidates received credit for all well-structured reasonable answers based off the syllabus content. Unsuccessful candidates named the biases without any supporting description, while others mixed up concepts between different biases.

Heuristics: Finance professionals tend to exclude specific information or process information incorrectly when advising clients. This situation is associated with a cognitive tool of decision-making in which individuals apply heuristics or mental shortcuts when processing large amounts of data or statistics that often result in mental mistakes. The advisor is using the shortcut of "20%" based on historical information. There is no guarantee that the heuristic would hold true this time around and he didn't attempt to analyze all the information available in the market.

5. Continued

Loss Aversion and the Disposition Effects: Portfolio managers may overweight losses compared to an equivalent gain relative to a reference point or anchor, and their behaviour depends on which side of the point their position lies. This behaviour results in the disposition effect in which professionals recommend retaining securities too long in order to recoup losses. The advisor recommended against selling based on the rationale that as long as you keep holding the position, no loss would be realized. This may not be the optimal move in the portfolio management process and could end up a costly mistake.

Anchoring is the tendency for experts to have a belief and then apply it as a reference point for making future judgments. Because finance practitioners often base their decisions on the first piece of information they receive such as a stock's initial purchase price, they have difficulty modifying their assessment to new information. The advisor referred back to his purchase for another client five years ago. Back then he may have done good analysis but it'd be hard to believe that nothing has changed since then. The advisor is anchoring to the first piece of information he had on the company.

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

Commentary on Question:

The candidates performed below average on this part. Many candidates successfully identified at least one bias. Unsuccessful candidates named biases without providing any explanations relating to the question.

Herding behavior: Institutional investors display a propensity to herd or to follow each other's trades. They infer information from each other's trades. They also analyze similar information and draw the same conclusions about the fair values of specific securities. As some institutions began to sell AAA for some reason, more institutions likely followed suit, pushing the prices lower.

Momentum Trading: Momentum trading refers to an investment strategy that tries to benefit from the continuance of existing market trends. As AAA began to tend down, the momentum traders would have followed the trend to sell and push the prices even lower.

5. Continued

- (c) Calculate your manager's misfit risk.

Commentary on Question:

The candidates performed as expected. Many candidates received full credits for successfully completing the calculation. Those who wrote down correct formulas and/or intermediate steps received partial credits even if the final solution was incorrect. A notable number of candidates used a wrong formula to calculate the misfit risk.

Manager's true active return = Manager's return – Manager's normal benchmark
= 10% - 15% = -5%

Manager's true active risk = Manager's true active return / Information Ratio = -5% / -1.118 = 4.47%

Manager's misfit risk² = Manager's total active risk² – Manager's true active risk² = 6%² – 4.47%²

Manager's misfit risk = 4%

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 - The theory and techniques of portfolio asset allocation.

Learning Outcomes:

- (6d) Propose asset allocation strategies and explain the impact of asset allocation relative to various investor goals and constraints
- (6e) Develop and critique asset allocation strategies appropriate to underlying liability profiles
- (6f) Evaluate the difficulties of investing for long tail liabilities (i.e. beyond 30 years) such as inflation indexed pension plans and secondary guarantee universal life insurance
- (6g) Understand and apply the concept of risk factors in the context of asset allocation

Sources:

QFIP-139-19 – IAA Risk Book Ch. 13 – Asset Liability Management

Commentary on Question:

This question tests the candidate's knowledge of the considerations that must be taken for asset allocation strategies of long tail liabilities.

The candidates performed as expected on this question. Candidates that did well provided answers that related specifically to Company XYZ and the situation described by the question. Candidates that did poorly did not tie their answers back to the situation presented in the question.

Solution:

- (a) Define in words:
- (i) Macaulay duration
 - (ii) Effective duration
 - (iii) Dollar duration
 - (iv) Partial duration

6. Continued

Commentary on Question:

The candidates performed as expected on this section. The candidates that performed above averaged described in words each item listed, clearly identifying the key feature of that duration compared to the others in the list. For example, a description of Effective Duration included the concept of percentage change in the asset value to clearly contrast that to the Dollar Duration that included the concept of a dollar change to the asset value.

Macaulay duration – A measure of interest rate sensitivity of the present value of cash flows. It is calculated as the time weighted present value of cash flows divided by present value of cash flows.

Effective duration – A measure of interest rate sensitivity to parallel shifts in the yield curve. Can be calculated by shocking the yield curve used to value the asset up and down and dividing the difference by the unshocked asset value. Result is the sensitivity of the asset value for a parallel shift in yield curve as a percentage of the asset value.

Dollar duration – Similar to Effective duration but measures interest rate sensitivity in dollar terms of the present value of cash flows for parallel shifts in the yield curve. Can be calculated as the product of Effective Duration and Asset value.

Partial duration – Similar to Effective duration but measures interest rate sensitivity to a single point on the yield curve. Can be calculated by partitioning the yield curve by various terms and shocking each term separately to measure the impact to the present value of cash flows.

- (b) Explain four reasons that the value of the assets could move differently from the effective duration predicted value.

Commentary on Question:

The candidates performed above average on this section. Candidates that did well described the drawbacks of Effective durations and how these drawbacks occur in reality but are not captured by Effective duration.

Duration measures the exposure to an immediate shock on the present value of cash flows and assumes that shock persists indefinitely into the future; in reality present values are constantly changing due to constantly changing yields

Duration is based on small, parallel changes in the yield curve; in reality changes are not parallel, additionally history has proven that large shifts in yield curves can happen

6. Continued

Duration is based on the first derivative but the second derivative, Convexity, should be considered: as interest rates decrease, the increase in present value of asset cash flows increases at a faster rate

Duration is typically calculated using either a risk-free rate or a risky-rate with a static credit risk component; it is possible that the credit spreads may change

Optionality in the assets may cause asymmetric price changes as interest rates change. Consider the example of an MBS that has underlying prepayments that impact the assets cash flow.

- (c) Identify two risks that XYZ faces in a falling interest rate environment.

Commentary on Question:

The candidates performed above average on this section. Candidates that did well listed the risk and described the risk. Candidates that did poorly only listed the risks. Three risks are provided below but describing two risks was sufficient for full marks as the question only asked for two risks.

Interest Rate risk / Asset-Liability Mismatch risk – Asset duration is shorter than liability duration; in falling interest rate scenario, liabilities will be much larger than asset values

Reinvestment risk – in a low interest rate environment, maturing bonds and cash inflow (e.g. reinvested assets) may not earn enough interest to support liabilities that were priced during the higher interest rate environment.

Options/Guarantee risk – policyholders may have incentives in a low interest rate environment to cash out in-the-money guarantees; bond issuers may be able to call the bond early (incentive to replace with a lower paying bond) reducing the higher interest coupon..

- (d) Your assistant reviewed XYZ's ALM policy along with current economic conditions and made the following suggestions:
- In the current low interest rate environment, the company should lower the allocation in bonds and increase allocation to equities to boost investment earnings.
 - With a nearly flat yield curve, the company should reduce the duration of the assets to stay liquid in case interest rates spike up.
 - The company should invest in emerging market debt because it achieved a high rate of return last year.

Critique your assistant's suggestions.

6. Continued

Commentary on Question:

The candidates performed poorly on this section. Candidates that did well described the shortfalls of the assistant's suggestion as it relates to XYZ's situation, particularly the large duration mismatch between the assets and liabilities.

The assistant's suggestion doesn't seem to consider the significant duration mismatch between the assets and liabilities. The primary goal of ALM is to minimize asset-liability mismatch to immunize the portfolio against interest rate risk. With this in mind, the assistant's suggestions need to consider the following:

Statement 1:

- Equity has a zero (or near zero) duration so allocating more to equities will shorten the asset duration, creating a larger mismatch between the asset and liability durations.
- Allocating more to equities can result in higher financial statement volatility.
- Allocating more to equities can result in higher capital requirements.
- Simply focusing on more return is not properly managing the surplus of the company.

Statement 2:

- Duration between asset and liability should be closely matched for better immunization, not just because the yield curve is flat.
- ALM frameworks are not based on timing interest rate changes because it is difficult to predict rates

Statement 3:

- Allocating to emerging market debt exposes the company to currency risk.
- Currency risk is not possible to hedge unless the liability duration is short.
- Historical interest rates are not predictors of future yields

7. Learning Objectives:

3. The candidate will understand the variety and assess the role of equities in investment portfolios. The candidate will demonstrate an understanding of the distinguishing investment characteristics and potential contributions to investment portfolios of the following major asset groups:
- Real Estate
 - Public Equity
 - Private Equity
 - Infrastructure
 - Commodities
 - Hedge Funds

Learning Outcomes:

- (3b) Demonstrate an understanding of the types of equity investments available for an investor's growth allocation and their most important differences
- (3c) Demonstrate an understanding of the investment strategies and portfolio roles that are characteristic of each equity investment

Sources:

QFIP-126-162: Infrastructure as an Asset Class

Commentary on Question:

This question tested the candidate's understanding of infrastructure as an asset class, including some of the difficulties inherent in investing in infrastructure.

Candidates performed above average on this question overall. While partial credit was available throughout, the best responses directly responded to the question's instructions and referred to material found in the source text.

Solution:

- (a) Explain whether or not the infrastructure asset class satisfies each of ABC's requested investment characteristics.

Commentary on Question:

Candidates performed brilliantly on this section. Some candidates lost points for not explaining their answer. Because infrastructure studies and data are limited, well defended answers for either response were awarded full credit for most characteristics.

-Infrastructure is a "real asset class" and is sought as an inflation hedge, although some researchers contest these results.

-Infrastructure is difficult to convert into liquid assets, does not satisfy liquidity characteristic.

- Infrastructure has low correlation with other asset classes based on historical data, although stability of this relationship isn't clear.

7. Continued

- Infrastructure has significant regulatory risk.
- Infrastructure studies show high risk-adjusted returns compared to other asset classes, although this data is limited since the financial crisis.
- Infrastructure typically has long durations, but there is a wide variation.

- (b) Describe 4 key risks associated with infrastructure projects and companies.

Commentary on Question:

Candidates performed as expected on this section. Candidates with the best answers identified key risks from the source material and described them. Partial credit was awarded for describing other risks.

4 key risks associated with investing in infrastructure projects include:

- Construction risk
 - Risk of loss specific to construction projections
- Operation and management risk
 - Risk of loss resulting from inadequate of failed procedures, systems, or policies
- Business risk
 - Risk of commercial business making inadequate profits
- Leverage, interest rate risk
 - Risk of loss due to leveraged positions

- (c) Describe 4 possible methods for benchmarking infrastructure assets.

Commentary on Question:

Candidates performed below average on this section. Candidates who recognized the source material typically received full or most credit. Partial credit was awarded for other well-explained methods.

4 possible methods for benchmarking infrastructure assets include:

- The inflation rate plus some margin
- LIBOR or bond yield or nominal GDP plus some margin
- A blend of equity, real-estate, bond and private-equity benchmark
- A listed infrastructure index

7. Continued

- (d) Recommend whether or not ABC should invest in the infrastructure asset class.

Commentary on Question:

Candidates performed above average on this section. Any recommendation was acceptable so long as it was defended well, and many candidates received full credit. Some candidates lost credit for not providing a clear recommendation. Other candidates provided reasoning that was either too short or contradicted their recommendation. A few candidates did not understand the characteristics of universal life and/or LTC products.

Restating the answer to part (a) was not sufficient to earn full credit. The best answers made a clear recommendation, provided justification beyond their response to part (a), and addressed possible counter-points.

ABC should invest in the infrastructure asset class because it satisfies several of the company's desired investment characteristics. Because ABC specializes in long-duration products and currently has a very safe and highly liquid asset portfolio, there is considerable opportunity to diversify ABC's asset portfolio and generate higher returns. There is some justifiable criticism that infrastructure's low liquidity is a risk for a life insurance company, but because ABC specializes in long-duration products liquidity risk is less of a concern. Additionally, even a small position of 5-10% could add considerable value while limiting risk exposure.

8. Learning Objectives:

3. The candidate will understand the variety and assess the role of equities in investment portfolios. The candidate will demonstrate an understanding of the distinguishing investment characteristics and potential contributions to investment portfolios of the following major asset groups:
- Real Estate
 - Public Equity
 - Private Equity
 - Infrastructure
 - Commodities
 - Hedge Funds

Learning Outcomes:

- (3c) Demonstrate an understanding of the investment strategies and portfolio roles that are characteristic of each equity investment.
- (3d) Demonstrate an understanding of the due diligence process for different types of equity investments.

Sources:

Managing Investment Portfolios: A Dynamic Process 3rd Edition, Chapter 8

Commentary on Question:

This question tests candidate's understanding on different hedge fund types, the potential concern for survivorship bias, and Sharpe ratio calculation and limitations. Overall, candidates performed below average on this question.

Solution:

- (a) Describe:
- (i) key features of these two types of hedge fund investments
 - (ii) the potential concern of the survivorship bias for investors in them

Commentary on Question:

The candidates performed below average on this part. Some candidates were able to describe the key features of the two hedge fund types. Many candidates were able to explain what survivorship bias is, but only a few candidates were able to identify the potential concern of survivorship bias in these two hedge fund types.

- (i) Hedged equity attempts to look for market opportunities by identifying overvalued and undervalued equity securities. Portfolios are not structured to be market neutral and could be highly concentrated in one position. It is the largest of the various types of hedge fund investments.

8. Continued

Fund of funds is a fund that invests in a number of underlying hedge funds. Typically invest in 10-30 hedge funds thus more diversified, but also more expensive because it has to pay two layers of fees.

- (ii) Survivorship bias has less direct impact on FOFs because hedge funds that dissolve are include in the returns of the FOFs. Survivorship bias can be significantly reduced by conducting due diligence. FOF with carefully screened funds will have much lower survivorship bias.

Survivorship bias is significant for hedge equity funds: overestimation of historical performance because of survivorship bias has been previous reported to range from 1.5% - 2%. The bias may be concentrated in certain periods, thus historical survivorship bias may over- or underestimate future bias.

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

Commentary on Question:

Candidates performed below average on this question. Candidates in general answered as expected for Statements 4 and 5. Some candidates only stated agree/disagree, or provided irrelevant explanations, and only partial credit was awarded. Candidates who provided correct explanations to each statement, but did not critique on colleague proposal at the end, also received most of the credit.

1. Disagree - Both investments only open to accredited investors.
2. Disagree - Compensation arrangements are SIMILAR.
3. Agree - Hedge funds often trade in individual securities and concentrates on inefficiencies in micro stock and bond markets, whereas managed futures trade mainly market-based futures and options contracts on broader baskets of assets and look for return opportunities in macro stock and bond markets.
4. Disagree - Managed futures trade exclusively in derivative markets whereas hedge funds tend to be more active in spot markets while using futures markets for hedging.
5. Disagree - In some jurisdictions, managed futures have been more highly regulated than hedge funds

Managed futures are not more liquid, they are not less expensive, they are traded exclusively in derivative markets, and they are more regulated, so the colleague's proposal is inaccurate.

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

8. Continued

Commentary on Question:

Candidates performed as expected on this part. Many candidates were able to calculate the Sharpe ratio for Portfolio B and C, but some candidates used an incorrect formula. Some candidates did not calculate portfolio A's Sharpe ratio to conclude B and C are better. Some candidates incorrectly interpreted skewness, or did not use this information, to conclude C is better than B.

$$R_f = 3.6\%$$

$$SR_A = (6-3.6)/12 = 0.2$$

$$SR_B = ((0.9*6+0.1*12)-3.6)/10 = 0.3$$

$$SR_C = ((0.9*6+0.1*9)-3.6)/9 = 0.3$$

Both Portfolio B and C have better Sharpe Ratio than the current portfolio.

Alternative investment should be added to the current portfolio. $SR_B = SR_C$

Skewness is a measure of asymmetry in the distribution of returns. All else being equal, a positive value of skewness is desirable.

Portfolio C should be selected as $SR_B = SR_C$, but Portfolio C is positively skewed whereas Portfolio B is negatively skewed. As we aim to achieve consistent positive returns, positive skewness is desirable.

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

Commentary on Question:

Candidates performed below average on this part. Many candidates stated the limitation of the Sharpe ratio, but did not explain how the Sharpe ratio can be artificially increased. Some candidates only provided the method (ex: buy put) but did not explain how it can increase the Sharpe ratio. Any three statements from below were required to receive full credit.

- Lengthening the measurement interval. This results in a lower estimate of volatility, which in turn improves the Sharpe ratio.
- Compounding the monthly returns but calculating the standard deviation from the monthly returns that are not compounded.
- Writing out-of-the-money puts and calls on a portfolio or adopting strategies that involve taking on some forms of catastrophe risk. This type of strategy can increase the return by collecting option premiums without paying off for years.
- Smoothing of returns: reducing return volatility by having infrequent marking to market of the portfolio assets or having pricing models that understate monthly gains or losses.
- Getting rid of extreme returns: entering into a total-return swap to pay the best and worst returns for the underlying benchmark index and receive fixed cash flow. This way the extreme returns are removed, and volatility is smoothed.

9. Learning Objectives:

4. The candidate will understand the nature, measurement and management of liquidity risk in financial institutions.
5. The candidate will:
 - Demonstrate an understanding of regulatory and accounting frameworks around investment governance.
 - Understand how to develop an investment policy including governance for institutional investors and financial intermediaries within regulatory and accounting constraints.
 - Understand how rating agency frameworks affect portfolio construction and management.

Learning Outcomes:

- (4e) Understand and apply techniques to manage stress liquidity risk
- (5f) Analyze international accounting treatment for insurance liabilities and the investments and hedging that supports them

Sources:

QFIP-148-20: IFRS 17 Standards Effects Sec. 1, 2, 4, 6.1-2,7.1

QFIP-150-20: IFRS 9 for Insurers

QFIP-149-20: PWC in Depth - IFRS 17

QFIP-123-16: Liquidity Risk Management CRO Forum

Commentary on Question:

This question tested candidate's general understanding of IFRS17 and IFRS9. Candidates performed below average on this question. Many candidates did not have a good understanding of IFRS17 nor IFRS9. Most candidates failed to relate IFRS17 with IFRS9 in terms of accounting mismatch.

Solution:

- (a) Recommend the IFRS 9 accounting treatment that should be applied to each asset.

Commentary on Question:

Candidates performed below average on this section. Most candidates were not able to recall the different accounting treatments under IFRS9. Some candidates were able to categorize the asset treatment correctly, however, did not provide any rationales behind the categorization.

9. Continued

Long-term secured government bonds	Amortised Cost <ul style="list-style-type: none"> • Assets are held to maturity • Represent SPPI • No accounting mismatch
Long-term A-rated corporate bond	FVOCI <ul style="list-style-type: none"> • Available for sale • Represent SPPI • No accounting mismatch
Exchange Traded Fund (Equity)	FVP&L <ul style="list-style-type: none"> • Hold for trading
Non-Investment grade	FVP&L <ul style="list-style-type: none"> • Derivatives

- (b) Explain why there will be accounting mismatches between the financial results from the assets and liabilities for ABC Life in the context of IFRS 9 and IFRS 17.

Commentary on Question:

Candidates performed poorly on this section. Most candidates did not understand the accounting mismatch between IFRS17 and IFRS9.

Whole Life and Term Life products are recognized in IFRS17 under General Measurement Model (GMM). The discount rate for the liability reflects the time value of money and the liquidity risk of the liability portfolio. The CSM represents the unearned profits from the insurance contracts. Any adjustment in discount rate affecting the future insurance services flows through CSM rather than P&L directly.

The discount rate can be determined using either bottom-up or top-down approach. Bottom-up approach assumes a risk free rate and adds back the liquidity premium. The top down approach assumes a risky asset portfolio and then adjusts the risk premium to create a risk-free asset. In either approach, the credit risk is pulled out of the discount rate.

Depending on the accounting treatment of the assets under IFRS9, any changes in discount rate due to credit movement can flow through P&L or OCI. The value of the liability and assets do not move in tandem, creating an accounting mismatch.

- (c) Describe the liquidity risk to which ABC Life is exposed under the applicable stress tests ABC Life should perform.

9. Continued

Commentary on Question:

Candidates performed below average on this section. Most candidates were only able to identify one or two scenarios. A few successful candidates identified enough scenarios to gain full marks.

Catastrophic claims scenario;

- Sharp increase in whole life and term life claims increases cash outflows
- Require access to cash – could be constrained if accompanied by strained market liquidity and/or portfolio with higher proportion of less liquid assets

Customer panic scenario;

- Sharp increase in lapses of whole life policies increases cash outflows
- Potential increase in loans on WL policies

Impaired Market/Panic Withdrawal Scenario

- Impaired market liquidity creates difficulty in meeting cash outflow demand resulted from the previous two scenarios.

10. Learning Objectives:

5. The candidate will:
 - Demonstrate an understanding of regulatory and accounting frameworks around investment governance.
 - Understand how to develop an investment policy including governance for institutional investors and financial intermediaries within regulatory and accounting constraints.
 - Understand how rating agency frameworks affect portfolio construction and management.

Learning Outcomes:

- (5a) Describe the regulatory and rating agency contexts in which various institutions operate and how those contexts affect portfolio strategy
- (5b) Explain how investment policies and strategies can manage risk and create value
- (5d) Determine how a client's objectives, needs and constraints affect investment strategy and portfolio construction. Considerations and constraints include:
 - Capital and expected return on allocated capital
 - Risk appetite and risk-return trade-off
 - Tax
 - Accounting
 - Regulators
 - Rating agencies
 - Liquidity
- (5e) Incorporate financial and non-financial risk into an investment policy, including currency, credit, spread, liquidity, interest rate, equity, insurance product, operational, technology, legal, political, reputational, and environmental, social, and governance (ESG) risks

Sources:

Maginn and Tuttle Chapter 1

QFIP-137-19: Managing Your Advisor (Ford note)

QFIP-136-19: Elements of and Investment Policy Statement (CFA note)

Commentary on Question:

This question tests the application and effectiveness of an Investment Policy Statement for two very different investors.

Solution:

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

10. Continued

Commentary on Question:

Candidates scored below average on this question. Many candidates failed to outline the scope and purpose of an IPS but instead provided general risk management practices.

Define the Investor

- Define who the investor is
- Specify which of the investor's assets are to be governed by the IPS

Define the Structure

- Set forth key responsibilities and actors
- Identify an organization structure for investing
- Identify a risk management structure applicable to investing
- Assign responsibility for monitoring and reporting
- Document acceptance

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

Commentary on Question:

Candidates scored above average on this question in general. Many candidates only analyzed one of risk or return objectives and received partial credit. A few candidates received full credit for discussing each of the bullet points shown below.

- Investment objectives are return and risk
- Return for Life insurer determined by rates used for reserves
- Return for wealthy couple determined by individual circumstances, but in this case long term growth appears to be the objective
- Risk tolerance for Life insurer is low due to regulatory and rating agency constraints
- Risk tolerance for wealthy couple appears to be high

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

Commentary on Question:

Candidates scored below average on this part of the question. Most candidates answered general risk management practices (and received partial credit) but not governance considerations to be included in the IPS.

Responsibility for determining and executing investment policy.

Documents accountability for all stages of investment policy development
Example: Board of Directors Investment Committee is responsible for determining

10. Continued

Process for reviewing and updating IPS.

Process for refreshing IPS as investor circumstances or market conditions change should be clearly identified in advance

Example: Each Investment Committee meeting will have an agenda item for reviewing market conditions or proposed changes

Responsibility for engaging and discharging external advisers

IPS should state who is responsible for hiring/firing external money managers, consultants, or other vendors

Example: Investment Committee delegates to Chief Investment Officer responsibility for hiring/firing external managers, etc.

Description of roles and responsibilities of boards and staff

The roles and responsibilities for oversight boards and management staff should be identified in the IPS

Example: Investment Committee responsible for setting, approving, and reviewing policies, etc.

Responsibility for determination of asset allocation

Having an asset allocation framework, as direct part of IPS or appendix, provides strategic context for tactical decisions

Example: Asset Allocation plan documents Investment Committee's expected equity, fixed income, etc. return assumptions

Responsibility for risk management, monitoring, and reporting

The IPS should document who is responsible for setting risk policy, monitoring the risk profile, and reporting on portfolio risk

Example: Chief Financial Officer responsible for executing risk management policies

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

Commentary on Question:

Candidates performed above average in this part of the question. Many candidates answered less than four constraints and only received partial credit but almost every candidate provided at least one of the constraints.

Liquidity requirements for insurer depends on regulations and liabilities. For the wealthy couple, liquidity may be needed for philanthropic efforts, but not for passing wealth on to heirs.

Time horizon for insurers is based on when liabilities are due. For the wealthy couple, time horizon is very long, depending on their age and health.

Tax considerations for insurers will likely be very different from individual.

Regulatory and legal – many constraints from insurers from NAIC, states, tax regs, concentration of holdings, etc. Far fewer regulatory and legal constraints for individual investors

Unique needs and preference – will be very difference between the two investors

11. Learning Objectives:

7. The candidate will understand the need for and goals of assessing the performance of a portfolio, and the methods and limitations of performance attribution.

Learning Outcomes:

- (7a) Explain the use of segmented asset portfolios for supporting different investment objectives
- (7b) Apply performance measurement methodologies to various asset portfolios
- (7c) Describe and assess techniques to select or build an asset benchmark for a given investment objective
- (7d) Assess and interpret performance attribution metrics for a given asset or portfolio

Sources:

Managing Investment Portfolios, Maginn & Tuttle, 3rd Edition, 2007, Ch. 12, p.738-740.

Managing Investment Portfolios, Maginn & Tuttle, 3rd Edition, 2007, Ch. 12, p. 731-732.

Managing Investment Portfolios, Maginn & Tuttle, 3rd Edition, 2007, Ch. 12, p. 770, 777.

Commentary on Question:

This question tested the knowledge of benchmark portfolios and the returns of different investment styles when compared to those benchmark portfolios.

Solution:

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

Commentary on Question:

The candidates performed below average on this section. Some candidates received full credit for the answers they provided. Many candidates, while receiving partial credit for providing the qualities of an ideal benchmark did not provide sufficient explanations of why the proposed benchmark is not ideal.

An ideal benchmark has the following qualities:

- Investable
- Measurable
- Unambiguous
- Specified in Advance
- Consistent with managers options
- Owned by the manager.

11. Continued

The proposed benchmark has a number of flaws that do not meet the criteria for an ideal benchmark:

- The benchmark is not investable. Cannot invest in the top quartile of peer group because that is not known until after
- Not specified in advance. Cannot know the top quartile until after
- It is an ambiguous benchmark because there is subjectivity in determining what is included in the “peer group“
- The benchmark suffers from survivorship bias because only the funds that perform well will still be around at the end. Poor performing funds will be shut down.

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

Commentary on Question:

The candidates performed below average on this section. Some candidates received full credit for their answers. Many candidates did not document where the values came from or the underlying formulas used.

Market Return = Russell 3000 Index = 25.2%

Style Return = (Russell 1000 Value Index – Market Return) = (21.7% - 25.2%) = -3.5%

Active Return = (Actual Return – Benchmark) = (23.5% - 21.7%) = 1.8%

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

Commentary on Question:

The candidates performed below average on this section. Some candidates received full credit for their answers on this section. Some candidates did not provide appropriate interpretations given their responses to part b.

The style return is negative which means that the particular style that the investment manager employs underperformed the market during the period.

However, the active return is positive which means that the manager outperformed his style benchmark and added value through active management.

Even though the actual return underperformed the market, the active manager still added value through active management because he outperformed his benchmark.

11. Continued

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

Commentary on Question:

The candidates performed below average on this section. Most candidates received partial credit for being able to calculate the Information Ratio for both ABC and DEF. Some candidates received partial credit for their explanations of the values from the table that they had used. Many candidates received no credit for only pulled single values from the table rather than values from each of the durations given.

The information ratio= active return/active risk.

For ABC, $IR=1.5\%/2.24\%=0.67$

For DEF, $IR=4\%/10\%=0.4$

From the table, we know the probability of DEF($IR=0.4$) is lower than that of ABC ($IR=0.67$) for all years 1 to 20.

So, DEF has the lower chance to outperforming the benchmark.

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

Explain the shortcomings of your colleague's recommendation.

Commentary on Question:

The candidates performed poorly on this section. Many candidates did not mention either Qualitative criteria or costs of manager turnover.

My colleague is only considering the additional return DEF offers, but is not considering the additional risk, or the change that each fund actually outperforms the benchmark (in other words, actually provides active management value).

Thus, while DEF has a higher average value added return, this return comes with significantly more risk. Also, as determined in part (d), DEF actually has a lower chance of outperforming the benchmark at each year

In summary, average annual value added return is a single metric and no single metric can perfectly tell you what the right investment is. Thus, we should also take into account variability of returns, information ratio, and probability of outperforming benchmark, all of which favors ABC

12. Learning Objectives:

4. The candidate will understand the nature, measurement and management of liquidity risk in financial institutions.

Learning Outcomes:

- (4b) Demonstrate an understanding of various liquidity measurement tools and metrics

Sources:

QFIP-134-19: Quantitative Credit Portfolio Management, Ben-Dor, et. al., 2012, Ch. 5 and 6.

Commentary on Question:

This question tests the measurement and management of liquidity risk in financial institutions during a financial crisis and the usage of Liquidity Cost Scores to influence asset selection.

Solution:

- (a) Explain why a spread decomposition can be useful for your company.

Commentary on Question:

Candidates performed as expected in this section. Almost all candidates mentioned elements of the credit bond spreads but a few listed all three components. In addition, many candidates were able to explain the spread decomposition as means to identify sources of changes for OAS. Also, all candidates missed the investment strategies to utilize with expected default losses and for a long-term investor.

Credit bond spreads can be decomposed into a risk premium, default cost and liquidity cost component. Understanding the OAS movement allows investors to protect the portfolio from particular sources of OAS changes or take advantage of the changes.

Since the market crises is worsening and the credit bond spreads are rising, spread decomposition can tell us whether it is due to higher liquidity cost and high-risk premium or to expected default losses.

If it is due to expected default losses then it is better to sell the bond and or hedge with a CDS.

Also, as a long-term investor, ABC with a buy and hold strategy can also buy the bond in the crisis period.

12. Continued

- (b) Recommend a derivative instrument that can be used to hedge market liquidity risk.

Commentary on Question:

Candidates performed below average in this section. A few candidates identified the VIX futures instrument as a good hedging tool for market illiquidity. Very few candidates mentioned its close relationship with LCS.

Candidates missed identifying its correlation with LCS and also it being a measure to reflect the volatility of the equity market. Some candidates identified the credit default swaps (CDS) as an instrument to hedge, but this explanation received only partial credit.

The VIX futures shows a close relationship with Liquidity Cost Score (LCS).

The correlation is about 0.90

VIX futures are a measure of implied volatility in equity markets.

VIX futures might be a good hedging tool for market illiquidity

- (c) Explain the limitations of bid-ask indications and possible ways to overcome them.

Commentary on Question:

Candidates performed below average in this section. Very few candidates identified the third limitation and mitigation strategy below in the context the trader reflects a theoretical recommendation instead the normal activity of the market, especially for less actively traded bonds.

Also, candidates generally did not identify the other limitations either.

First limitation of trader indications is the bond's bid-ask spread may not be the "market's best" bid-ask spread which may result in LCS overstating bond liquidity costs.

To mitigate this limitation, it is better to search across broker dealers.

Second limitation, the trader indications could be influenced by a trader's outlook or inventory. If a trader were temporarily long inventory of a particular bond, then the trader might quote the bond with a tighter spread.

To mitigate the temporary traders' positions we average bonds' bid ask spread indications over an entire month to produce a single monthly bid ask spreads.

Third limitation is that trader messages provide an indication of a theoretical representation of where a bond should trade and is usually tighter than a market quote. This is especially true for a less actively traded bond.

12. Continued

One way to mitigate is to look at high volume actively traded bonds since trader indication is likely to be close to the bond's market.

- (d) The new bond being considered has very high trading volume. The CRO thinks that since the bond has a high trading volume, the liquidity risk must be lower.

Explain whether the CRO is correct or not.

Commentary on Question:

Candidates performed below average in this section. In general candidates justified this is incorrect because the volume is not the only factor to consider. Candidates generally missed a key point to explain the context of high volume of selling during a crisis and its impact on LCS.

It is intuitive to think high trading volume will give high liquidity or low LCS. However, heavy selling especially during crises by investors in an illiquid market can lead to both very high volumes and high LCS or low liquidity. Therefore, high level of trading volume is not necessarily a guarantee of low LCS.

- (e) Recommend which one of the bonds to add to the existing portfolio.

Commentary on Question:

Candidates performed as expected in this section. Candidates were successful in justifying the better choice relatively using volume, issue size and age of bonds. Some candidates provided the justification with the use of a score table to select the better bond with a grading for each component associated with the level of liquidity. Most candidates were not able to identify the impact on LCS for quoted bonds and in general did attribute the lowest LCS to the final choice for bond E.

In general, more volume means better liquidity. Bonds E/F/G have the highest volume.

Bonds E/G have the lowest age of the bonds – long-term investors are reluctant to sell bonds such seasoned bonds will have higher LCS.

Bonds E/G/H have the highest issue size which means tighter bid ask spreads and lower LCS.

Bonds E/G are both quoted bonds, so no additional factors are needed as for non-quoted bonds of comparable age/size/volume.

12. Continued

We do not know the benchmark status of bonds E and G. Bond E and G have the lowest age, highest volume and highest issue size. Although we do know that Bond E is on-the-run issue.

So, we should add Bond E to the portfolio since Bond E will have the lowest LCS among.

13. Learning Objectives:

2. The candidate will understand:
 - The credit risk of fixed income portfolios, securities, and sectors and be able to apply a variety of credit risk theories and models.
 - How rating agencies rate corporate and sovereign bonds and securitized credit.

Learning Outcomes:

- (2b) Demonstrate an understanding of modeling approaches for correlated defaults.

Sources:

Credit Risk Modelling, Bolder, 2018, Chapter 3

Commentary on Question:

This question tested modeling approaches for correlated mortgage defaults, including characteristics of the credit risk model and how the models are applied. Overall, the candidates performed below average on this question.

Solution:

- (a) Identify desired characteristics of the credit risk model that make the choice of $p(Z)$ important.

Commentary on Question:

The candidates performed below average on this section. In order to receive full points, candidates must identify both fat-tailed and strongly dependent. Partial points were given if candidates identified other reasonable characteristics, for example, $p(Z) \in [0,1]$.

Fat-tailed and strongly dependent are desired characteristic of the credit risk model.

- (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

Commentary on Question:

The candidates performed poorly on this section. Most candidates calculated part (i) correctly; however, most candidates failed to calculate part (iv). Some candidates wrongly used $\text{Var}(I_{Dn})$ instead of $\text{Var}(p(Z))$ in the formula.

13. Continued

(i) $E[I_{Dn}] = p = \exp(\mu + \sigma^2/2) = e^{\ln(1/10)} e^{\ln(4)/2} = (1/40) \times \sqrt{4} = 0.05$

(ii) $\text{Var}(I_{Dn}) = p(1-p) = 0.05 \times (1-0.05) = 0.0475$

(iii) $\text{Cov}(I_{Dn}, I_{Dm}) = \text{Var}(p(Z))$ thus $= (\exp(\sigma^2) - 1) \times \exp(2\mu + \sigma^2)$
 $= (e^{\ln(4)} - 1) \times e^{2 \ln(1/40)} e^{\ln(4)}$
 $= (4-1) \times (1/1600) \times 4 = 12/1600 = 0.0075$

(iv) Variance of the number of defaults for the portfolio
 $= N p (1-p) + N (N-1) \text{Var}(p(Z)) = 1000 \times .05 \times (1-.05) + 1000 \times 999 \times .0075 = 7540$

- (c) Calculate the amount of capital required to cover expected losses plus two standard deviations above the expected losses due to default for the portfolio.

Commentary on Question:

The candidates performed poorly on this section. Many candidates solved for α and β correctly. Some candidates calculated $\text{Var}(Z)$ correctly. However, some candidates wrongly used $\text{Var}(Z)$ instead of $\text{Var}(Dn)$ in the final calculation.

$p = E[p(z)] = E[\text{Beta}(\alpha, \beta)] = \alpha / (\alpha + \beta) = 0.1$

and $\rho_{n,m} = 1 / (\alpha + \beta + 1) = .1$

solve for α and β , $\alpha = .9$ and $\beta = 8.1$

$\rho_{n,m} = \text{Cov}(I_{Dn}, I_{Dm}) / (\sqrt{\text{Var}(I_{Dn})} \times \sqrt{\text{Var}(I_{Dm})})$

where $\text{Var}(I_{Dn}) = \text{Var}(I_{Dm}) = p(1-p)$

and $\text{Cov}(I_{Dn}, I_{Dm}) = \text{Var}(Z) = \alpha\beta / [(\alpha + \beta)^2(\alpha + \beta + 1)] = 0.009$

$E[Dn] = N \times E[p(z)] = 1000 \times 0.1 = 100$ (3.10 p.90)

$\text{Var}(Dn) = N p (1-p) + N (N-1) \text{Var}(Z) = 1000 \times [0.1 \times 0.9 + 999 \times 0.009] = 9081$

$\sigma_{Dn} = 95.29$

Answer $= E[Dn] + 2 \sigma_{Dn} = \$100,000 \times (100 + 2 \times 95.29) = \$29,058,856$

- (d) Describe two limitations of binomial-mixture models.

Commentary on Question:

The candidates performed poorly on this section. Most candidates successfully identified the first limitation (common default probability) but not the second limitation (systematic factor). Also, many candidates answered general limitations which are not related to binomial-mixture models. No points were given to those answers.

13. Continued

Binomial-mixture models force common default probability for all debtors/obligors, and information on individual creditworthiness is lost. Also, it is not obvious how additional systematic factors might be introduced in this framework.

- (e) Calculate the correlation factor between Urban and Rural mortgages.

Commentary on Question:

The candidates performed poorly on this section. Some candidates calculated a properly but did not calculate the final answer correctly. Partial points were given if candidates successfully identified the formula and w_1 , p_u , p_s , and p_r .

$$\begin{aligned}\rho_{u,s} &= [w_1^2 / a] \times [(p_u p_s) / (\sqrt{p_u(1-p_u)} \sqrt{p_s(1-p_s)})] \\ 40\% &= [(.3^2) / a] \times [(10\% \times 12\%) / (\sqrt{10\% \times (1-10\%)} \times \sqrt{12\% \times (1-12\%)})] \\ a &= .0277\end{aligned}$$

$$\begin{aligned}X &= [w_1^2 / a] \times [(p_u p_r) / (\sqrt{p_u(1-p_u)} \sqrt{p_r(1-p_r)})] \\ X &= [(.3^2) / .0277] \times [(10\% \times 8\%) / (\sqrt{10\% \times (1-10\%)} \times \sqrt{8\% \times (1-8\%)})] = \\ &31.94\%\end{aligned}$$

14. Learning Objectives:

2. The candidate will understand:
 - The credit risk of fixed income portfolios, securities, and sectors and be able to apply a variety of credit risk theories and models.
 - How rating agencies rate corporate and sovereign bonds.

Learning Outcomes:

- (2a) Demonstrate an understanding of credit risk analysis and models
- (2c) Apply both threshold and statistical models of the term structure of defaults to analyze credit risk exposure
- (2d) Demonstrate an understanding of modeling approaches for correlated defaults

Sources:

Bolder, D, Credit-Risk Modelling, 2018, Chapters 4.

Commentary on Question:

Overall candidates performed below average on the question. Several candidates did not answer the question or answered only one or two parts of the question. Candidates that answered all parts of the question performed above average.

Solution:

- (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

Commentary on Question:

Candidates who answered this part of the question performed as expected. Candidates who performed poorly stated the answer for the covariance matrix without providing a derivation. Candidates who did well provided a derivation.

$$\begin{aligned} E(Y_i) &= E(\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_i) = \sqrt{\rho}E(G) + \sqrt{1-\rho}E(\epsilon_i) \\ &= \sqrt{\rho}(0) + \sqrt{1-\rho}(0) = 0 \end{aligned}$$

$$\begin{aligned} \text{Var}(Y_i) &= \text{Var}(\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_i) = \rho\text{Var}(G) + (1-\rho)\text{Var}(\epsilon_i) \\ &= \rho(1) + (1-\rho)(1) = 1 \end{aligned}$$

$$\begin{aligned} \text{Corr}(Y_1, Y_2) &= \text{Cov}(Y_1, Y_2) = E\left((Y_1 - E(Y_1)) * (Y_2 - E(Y_2))\right) = E(Y_1 Y_2) \\ &= E\left((\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_1) * (\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_2)\right) = E(\rho G^2) = \rho\text{Var}(G) = \rho \end{aligned}$$

Therefore, the covariance matrix of $[Y_1, Y_2]$ is

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}$$

and their joint distribution is multivariate standard normal distribution $\mathcal{N}(0,1, \rho)$

14. Continued

- (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 .

Commentary on Question:

Candidates who answered this part of the question performed as expected. Candidates who performed poorly started from the wrong equation. Candidates who did well recognized how to solve for G .

$$\begin{aligned} p_i &= \Pr(Y_i < K_i) \\ &= \Phi(K_i) \\ p_i(G) &= \Pr(Y_i < K_i | G) \\ &= \Pr(\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_i < K_i | G) \\ &= \Pr\left(\epsilon_i < \frac{K_i - \sqrt{\rho}G}{\sqrt{1-\rho}} \mid G\right) \\ &= \Phi\left(\frac{K_i - \sqrt{\rho}G}{\sqrt{1-\rho}}\right) \end{aligned}$$

$$\text{If } p_i < p_i(G), \text{ then } K_i < \frac{K_i - \sqrt{\rho}G}{\sqrt{1-\rho}}$$

$$\text{Solving for } G, \text{ when } G < \frac{K_i - K_i\sqrt{1-\rho}}{\sqrt{\rho}}, \text{ then } p_i < p_i(G)$$

- (c) Explain why the default correlation between obligors is different than the correlation between latent variables Y_i .

Commentary on Question:

Candidates who answered this part of the question performed below average. Candidates who performed poorly did not explain the difference between the two correlations. Candidates who did well explained how the correlations are different.

The correlation parameter ρ is the correlation between the latent variables, which can be interpreted as representing the credit health of the obligors.

The default correlation is focused only on correlation of default events, regardless of the value of the latent variables at default.

They are different because:

- The latent variables can be highly correlated, but depending on other parameters such as the thresholds K_i , the obligors could have very different probabilities of default and low default correlation.
- The default correlation depends on more than the latent variables, such as the joint probability of default.

14. Continued

- The correlation parameter is the correlation between two normal random variables, whereas the default correlation is the correlation between two Bernoulli random variables that are transformations of the normal (latent) variables.
- (d) Describe advantages that a threshold model using X_i as latent variables has over the Gaussian threshold model using Y_i .

Commentary on Question:

Candidates who answered this part of the question performed above average. Candidates who performed below average did not recognize the relationship between the t distribution and tail dependence. Candidates who did well fully explained the advantages of the X variable over the Y variable.

The Y_i latent variables are normally distributed do not exhibit tail dependence which means that Y_i are asymptotically independent.

This is a problem because credit risk is primarily concerned with the tail of the distribution.

The X_i latent variables are t -distributed random variables.

The tail-dependence coefficient is non-zero for the t -distribution for all values of $\rho \in (-1,1)$ and $\nu > 0$. This means that there is tail dependence for this distribution.

- (e) You are given that the covariance between any two X_i is 20% and the expectation of $1/W$ is 0.0556.

Calculate the correlation between any two X_i .

Commentary on Question:

Candidates who answered this part of the question performed above average. Candidates who performed poorly did not choose the two correct equations to perform the calculation. Candidates who did well did.

$$\text{cov}(x_i, x_j) = \rho \cdot \left(\frac{\nu}{\nu-2}\right)$$

$$E\left[\frac{1}{W}\right] = \left(\frac{1}{\nu-2}\right)$$

$$\text{corr}(x_i, x_j) = \rho$$

Solve for ρ

$$\nu = 2 + \frac{1}{.0556} = 20$$

$$\rho = \frac{20-2}{20} \cdot 20\% = 18\%$$

15. Learning Objectives:

3. The candidate will understand the variety and assess the role of equities in investment portfolios. The candidate will demonstrate an understanding of the distinguishing investment characteristics and potential contributions to investment portfolios of the following major asset groups:
 - Real Estate
 - Public Equity
 - Private Equity
 - Infrastructure
 - Commodities
 - Hedge Funds

Learning Outcomes:

- (3e) Demonstrate an understanding of the basic concepts surrounding passive, active, and semi-active investing.
- (3g) Explain the basic active equity selection strategies including value, growth and combination approaches, and compare techniques for characterizing investment style of an asset manager.

Sources:

Maginn & Tuttle, *Managing Investment Portfolios*, 3rd Ed. 2007, Ch. 7.1 – 7.6

Commentary on Question:

This question tests candidates' understanding of the theory and techniques of equity portfolio management. Candidates performed as expected on this question.

Solution:

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

Commentary on Question:

Candidates performed as expected on this part. Many candidates were able to evaluate the performance of each individual manager. A few candidates evaluated the overall portfolio and/or calculated the overall portfolio's active return and tracking risk, and only those candidates were awarded full credit for this part.

Manager A: contributes positive active return, but higher active risk than other two managers

Manager B: looks to be the best performer among the three, as he contributes more active return than active risk to the overall portfolio

Manager C: does not contribute active return nor active risk than the benchmark and looks he just manages an index fund

15. Continued

$$\begin{aligned} & \text{Portfolio active return} \\ &= \left(\frac{200}{200 + 100 + 400} \right) \times (2\%) + \left(\frac{100}{200 + 100 + 400} \right) \times (3\%) \\ & \quad + \left(\frac{400}{200 + 100 + 400} \right) \times (0\%) \\ &= 1\% \end{aligned}$$

$$\begin{aligned} & \text{Portfolio tracking risk} \\ &= \left[\left(\frac{200}{200 + 100 + 400} \right)^2 \times (4\%)^2 + \left(\frac{100}{200 + 100 + 400} \right)^2 \times (5\%)^2 \right. \\ & \quad \left. + \left(\frac{400}{200 + 100 + 400} \right)^2 \times (0\%)^2 \right]^{0.5} \\ &= 1.35\% \end{aligned}$$

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

Commentary on Question:

Candidates performed above average on this part. Most candidates were able to identify the investment style and strategy, and also give an explanation for it.

Investment strategy: active return investment

- because both the active return is bigger than 2% and tracking risk is greater than 4%.

Investment style: value investing because of the following reasons:

- He invests in securities having a P/E lower than the benchmark
- He invests in securities having a P/B lower than the benchmark
- He invests in securities having a dividend yield higher than the benchmark

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

Commentary on Question:

Candidates performed above average on this part. Most candidates correctly identified the approach, and also correctly identified the reason for it.

The managers' portfolios represent a **core-satellite portfolio**.

Manager C has an indexed investment, which represents more than half the portfolio's value and acts as a core.

Other actively managed portfolios represent the satellite portfolios surrounding the core.

15. Continued

- (d) Compare and contrast these two analyses.

Commentary on Question:

Candidates performed as expected on this part. Many candidates did not give a definition of the two style analyses. Most candidates provided a few characteristic of each of the two analyses.

Compare and contrasts of the two style analyses

	Return-Based	Holdings-based
Definition	it involves regressing the portfolio returns on the return series of a set of security indices.	it categorizes individual securities by their characteristics and aggregates results to reach a conclusion about the overall style of the portfolio at a given point in time.
	It characterizes the entire portfolio	Characterizes by each individual position
	It facilitates portfolio comparison	Facilitate individual position comparison
	It may be ineffective in characterizing current style	may capture changes in style more quickly than returns-based analysis in looking at the present
	Requires minimum information	It is more data intensive
	More cost effective and can be executed quickly	
	Different models usually give largely similar results and portfolio characterizations	It requires specification of classification attributes for style; different specifications may give different results.
	Errors in specifying indices in the model may lead to inaccurate conclusions	Does not have to specify any underlying indices
	It is a clear theoretical basis for portfolio categorization	

16. Learning Objectives:

1. The candidate will understand how to work with the variety of fixed income instruments and evaluate fixed income portfolios.

Learning Outcomes:

- (1b) Demonstrate an understanding of common techniques to enhance yield and manage liquidity in fixed income portfolios

Sources:

Fabozzi, *Handbook of Fixed Income Securities*, Ch58, p.1355-1359

Commentary on Question:

This question tested the candidates understanding of repurchase agreements.

Solution:

- (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.

Commentary on Question:

Candidates performed above average on this section. Nearly all candidates accurately described how an overnight repurchase agreement works. Some candidates did not explain why they are cost efficient and thus only received partial credit.

- (i) ABC Bank will agree to deliver (“sell”) the security to the customer (“counterparty”). ABC Bank agrees to buy the same security on the next day for an amount determined by the repo rate. The difference between the sale price and repurchase price is the interest cost of obtaining financing.
 - (ii) The advantage is that the repo rate is generally less than the cost of bank financing. From the perspective of the lender, the repo rate is still attractive because the transaction is secured and highly liquid.
- (b) Explain how two common practices are used to reduce credit risk in repurchase agreements.

Commentary on Question:

Candidates performed below average on this section. Many candidates listed common practices but provided no explanation of how they reduce credit risk and thus only received partial credit. Some candidates omitted this part of the question.

16. Continued

- The amount lent should be less than the market value of the security used as collateral. This provides the lender with a cushion should the market value of the security decline. The amount by which the market value of the collateral exceeds the value of the loan is called the margin.
- Another practice to limit credit risk is to mark the collateral to market on a regular basis. The decline in market value below a specific amount will result in a margin deficit. Margin deficits can be cured by either providing additional cash or transferring additional securities.

(c)

- (i) Describe a dollar roll transaction
- (ii) Explain how it differs from repo agreement.

Commentary on Question:

Candidates performed below average on this section. Many candidates accurately stated the dealer in a dollar roll only needs to return “substantially identical securities”, and also that the dealer keeps the coupons and principal paid during the loan period. Many candidates did not describe what “substantially identical securities” means. Most candidates did not mention that the flexibility provided to the dealer may result in a lower financing cost. Some candidates omitted this part of the question.

- (i) A dollar roll is a special type of collateralized loan in the MBS market. In a dollar roll, the dealer only needs to return “substantially identical securities.” These substantially identical securities must match the coupon rate and security type (i.e. issuer and mortgage collateral). This ends up providing flexibility to the dealer. In exchange for this flexibility, the dealer provides 100% financing (i.e. there is no overcollateralization required).
 - (ii) Unlike a repo agreement, the dealer who borrows the security does not need to return the exact same securities. The financing cost may be cheaper in a repo due to this flexibility given to the dealer. Additionally, unlike a repo, the dealer keeps the coupon and any principal paid during the period of the loan.
- (d) ABC bank enters into an agreement in which it agrees to sell \$1 million par value of a MBS at $101\frac{7}{32}$ and repurchase substantial identical securities a month later at 101. The coupon rate for this MBS is 7%, paid monthly. The regular scheduled principal payment for the month is \$1,000 and assumed prepayment is projected to be \$3,000.

16. Continued

Calculate the financing cost of this transaction in terms of an annual rate.

Commentary on Question:

Candidates performed below average on this section. Many candidates did not accurately calculate the principal repayment premiums gained due to the scheduled payment and prepayment. Many candidates did not have the right sign on some of the components in the total dollar financing cost calculation. Many candidates omitted this part of the question.

$$\text{Lost coupon interest} = 7\% * 1,000,000 / 12 = \$5,833.33$$

$$\text{Drop} = \$1,000,000 * 7/32 / 100 = \$2,187.50$$

$$\text{Principal repayment premium gained due to scheduled payment} = 1^{7/32} * 1,000 / 100 = \$12.19$$

$$\text{Principal repayment premium gained due to prepayment} = 1^{7/32} * 3,000 / 100 = \$36.56$$

$$\text{Total financing cost} = \$5,833.33 - \$2,187.50 - \$12.19 - \$36.56 = \$3,597.08$$

$$\text{Financing cost in terms of annual rate} = 3,597.08 / 1,000,000 * 12 = 4.32\%$$