

# Exam QFICORE

## AFTERNOON SESSION

**Date:** Wednesday, October 31, 2018

**Time:** 1:30 p.m. – 3:45 p.m.

### INSTRUCTIONS TO CANDIDATES

#### General Instructions

1. This afternoon session consists of 7 questions numbered 10 through 16 for a total of 40 points. The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### Written-Answer Instructions

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

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Tournez le cahier d'examen pour la version française.





**\*\*BEGINNING OF EXAMINATION\*\***

**Afternoon Session**  
***Beginning with Question 10***

**10.** (4 points) You are the chief investment officer (CIO) of a small company. The company has traditionally invested in high quality corporate bonds and mortgages only.

- (a) (1 point) Define high yield bonds and explain their common features.
- (b) (1 point) Describe four different types of issuers of high yield bonds and their objectives in issuing high yield bonds.

You are considering two alternatives to invest in high yield bonds:

- I. Individual high yield bonds
  - II. High yield bond exchange traded funds (ETF)
- (c) (1 point) Explain the advantages of each alternative.

Fixed Income ETF investors entering or leaving the ETF transact at the market price of the fund, while investors of a mutual fund with the traditional open-ended structure transact at the net asset value (NAV) of the fund.

- (d) (1 point) Compare the price execution of an ETF with transacting at the NAV of an open-ended mutual fund.

- 11.** (6 points) You are a portfolio manager for a bond fund and you are considering adding high yield bonds as an asset class to your portfolio.

One of your colleagues makes the following statements:

- I. During a bond issuance, a corporate trustee is a third party to the contract who represents the interests of the issuer.
- II. Investors generally find zero-coupon bonds less attractive in low interest rate environment.
- III. High yield bonds comprise a very small portion of the overall corporate bond market.
- IV. Given that high yield bonds are generally unsecured obligations, their covenants are usually stricter than those on loans.
- V. There are advantages for companies to use a blanket mortgage arrangement to issue first-mortgage bonds.
- VI. Collateral trust bonds are bonds secured by assets other than real property.

- (a) (2 points) Assess each of the statements above and explain your answers.
- (b) (1 point) Explain why companies would prefer to issue the following bonds:
  - (i) Pay-in-kind (PIK) notes
  - (ii) Bonds with incorporated poison puts

You just learned about a new issuance of a high yield bond. The issuer, Best Cosmetics, is a first-time issuer and an unfamiliar credit.

- (c) (1.5 points) Describe two primary types of syndication that Best Cosmetics may use for the bond issuance.

A 3-year bond is issued with semi-annual coupons at a bond equivalent yield (BEY) of 5%. You are given the following yields.

Yield to maturity (BEY)	6.0%
Yield to call (BEY)	7.0%

The bond is to be called at the end of 2 years.

- (d) (1.5 points) Calculate the call price of the bond.

**12.** (6 points) Mortgage backed securities have a variety of risks in addition to interest rate risk. Pension fund XYZ is thinking to invest in senior tranches of mortgage backed securities. The Board of Directors (BoD) of XYZ received two proposals to invest in:

- I. Non-agency Residential Mortgage Backed Securities (RMBS).
- II. Commercial Mortgage Backed Securities (CMBS).

(a) (2 points)

- (i) List the two principal risks inherent in a pool of residential mortgages that non-agency RMBS deals are structured to manage.
- (ii) Explain how non-agency RMBS deals are structured to manage these two risks.
- (iii) Compare non-agency RMBS and CMBS based on 3 key attributes.

Consider a newly written CMBS with an annual coupon rate of 3% and two sequential tranches: A senior tranche of \$20 million and a junior tranche of \$80 million. All payments received will be used to service senior tranches first.

The underlying mortgage pool is modeled based on generic 5-year mortgages with:

- Annual interest rate of 4.5%
- Prepayment rate of 150% PSA (see below)
- Default rate of 1% per year
- Recovery rate of 60%.

150% PSA model: Prepayments begin at a monthly conditional prepayment rate (CPR) rate of 0.3% in the first month and increase at a rate of 0.3% per month until they reach CPR of 9.0% in month 30.

(b) (2.5 points) Calculate expected amount for the following at the beginning of the second month post issuance, assuming both default and prepayment take place at the end of the month and that default takes place after prepayment.

	Principal Payment	Interest Payment	Remaining Par Value
Senior tranche			
Junior tranche			

## 12. Continued

Current portfolio of XYZ also contains callable bonds, so the BoD of XYZ is concerned with adding mortgage backed securities given a low interest rate environment and pessimistic macro-economic outlook.

(c) (1.5 points)

- (i) Explain the similarities in risk exposure between callable bonds and mortgage backed securities;
- (ii) Define a make-whole call provision and explain why it is preferable to fixed-price call provision.

13. (8 points) ABC sponsors a defined benefit (DB) plan with the following characteristics:

- Total assets: 200 million
- Total liabilities: 250 million
- Return on liabilities is modeled with respect to return on Long-Term Bonds (LTB) and noise, as follows:  $R_L = \alpha + \beta * R_B + N$ , where:
  - $\alpha$  and  $\beta$  are constants
  - $\alpha$  is the “return-adjustment”
  - $\beta$  is the “duration adjustment” coefficient, a ratio of the duration of liabilities to the duration of LTB
  - $R_B$  is the return on LTB
  - $N$  (noise) is normally distributed with mean 0 and standard deviation of 2%
  - $N$  is assumed to be independent of all asset returns
- $E(R_L)$  (expected return of liabilities L ): 5%
- Duration of liabilities: 15
- Duration of LTB: 12

The characteristics of the plan’s asset portfolio are as follows:

Asset Classes	Annual Expected Return	Annual Standard Deviation	Portfolio Weight	Correlation			
				DE	IE	LTB	RE
Domestic Equities (DE)	12%	15%	30%	1.0			
International Equities (IE)	10%	12%	30%	0.8	1.0		
Long-Term Bonds (LTB)	4.5%	8%	20%	0.2	0.0	1.0	
Real Estate (RE)	6%	10%	20%	0.4	0.3	0.1	1.0

To evaluate ABC’s DB plan’s asset portfolio allocation in one year, you decide to use the mean-variance surplus optimization (MVS0) approach.

Return on surplus  $R_{S,1}$  at time 1:

$$R_{S,1} = \frac{S_1 - S_0}{A_0} = \frac{(A_1 - L_1) - (A_0 - L_0)}{A_0} = R_A - \frac{L_0}{A_0} R_L$$

where

- $R_A$  is the return on assets  $A$ ,
- $A_t$  is the value of assets  $A$  at time  $t$ ,
- $L_t$  is the value of liabilities  $L$  at time  $t$ ,
- $S_t$  is the value of surplus  $S$  at time  $t$ .

### 13. Continued

Variances of return on assets, liabilities, and surplus are  $\sigma_A^2$ ,  $\sigma_L^2$ , and  $\sigma_S^2$  respectively.

$$\sigma_S^2 = \sigma_A^2 + \left(\frac{L_0}{A_0}\right)^2 \sigma_L^2 - 2\left(\frac{L_0}{A_0}\right) \rho_{A,L} \sigma_A \sigma_L$$

where  $\rho_{A,L}$  is the correlation coefficient of return on assets A and return on liabilities L.

$\sigma_A$  is calculated to be 9.0%.

- (a) (1 point) Determine  $\alpha$  and  $\beta$  and calculate  $\sigma_L$ .

You are given the following:

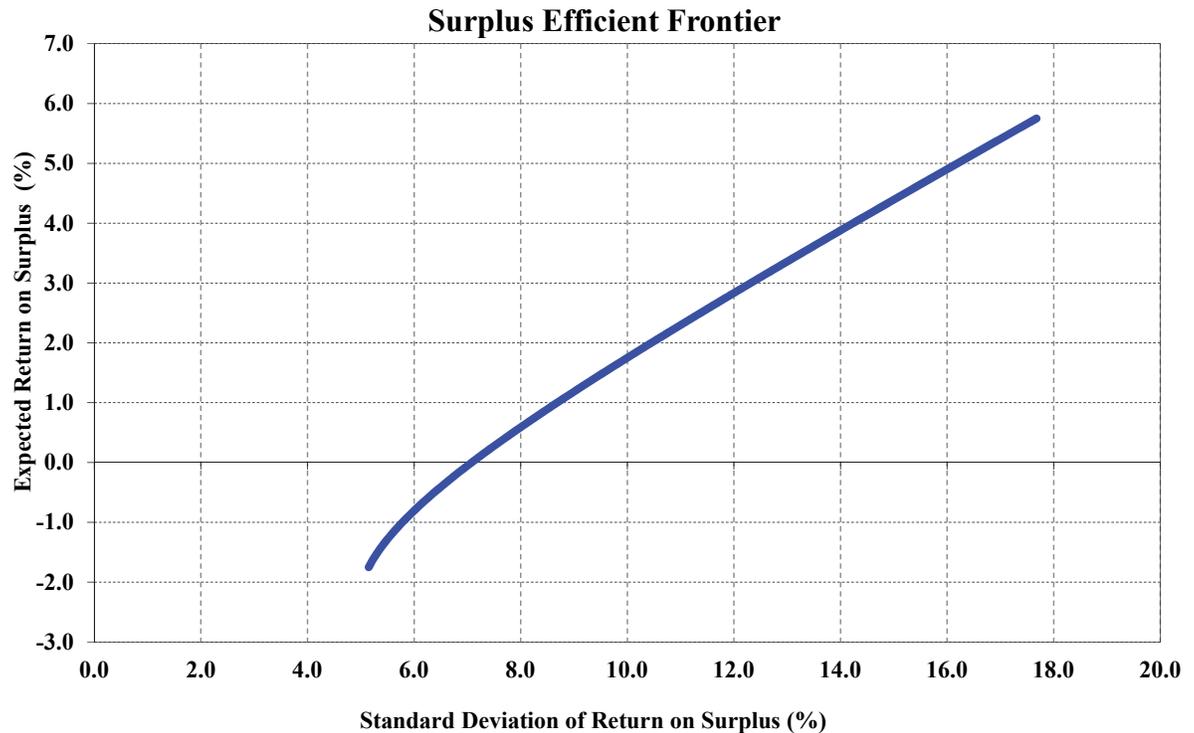
Asset Classes	Expected return on Surplus $E[R_{S,1}]$	Standard deviation of Surplus $\sigma_S$
Domestic Equities (DE)	5.75%	17.68%
International Equities (IE)	W	X
Long-Term Bonds (LTB)	Y	Z
Real Estate (RE)	-0.25%	15.41%

- (b) (1.5 points) Calculate W, X, Y, and Z in the table above.

*Question 13 continued on the next page.*

### 13. Continued

- (c) (2 points) Identify the position of current asset portfolio of ABC's DB plan in the expected return on surplus ( $E[R_{S,1}]$ ) and standard deviation of return on surplus ( $\sigma_S$ ) space (Surplus Efficient Frontier) below to determine if the portfolio is efficient.



- (d) (0.5 points) Outline the limitations of the MVSO approach.

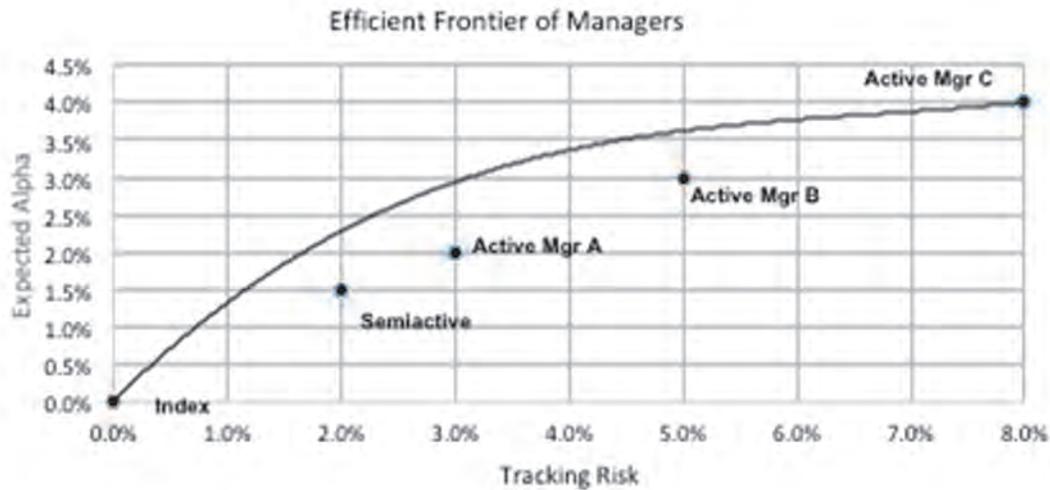
ABC would like to address the limitations of the MVSO approach using the Black-Litterman model.

You are given the following information:

- The expected returns given above are based on equilibrium market capitalizations.
  - ABC has the following independent views on the market:
    - RE will outperform LTB by 2% per year;
    - DE will outperform IE by 4% per year.
- (e) (2 points) Explain how optimal portfolio weights of ABC's DB plan asset portfolio will change under the Black-Litterman model.
- (f) (1 point) Describe additional considerations that may compensate relying on the MVSO approach in the asset portfolio allocation decision making process.

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14. (7 points) XYZ manages \$50 billion in equity assets backing pension liabilities in the U.S., Canada, and Europe. Its equity portfolio benchmark is the MSCI World Index. Using historical data, XYZ constructs the efficient frontier of its managers as follows.



(Note: Index is the benchmark MSCI World Index; Assume that active returns are uncorrelated.)

XYZ's current portfolio mix is as follows:

	<b>Allocation</b>
Index	20%
Semiactive	40%
Active Manager A	20%
Active Manager B	10%
Active Manager C	10%
Total	100%

- (a) (2 points) Calculate the information ratio of the XYZ equity portfolio.

## 14. Continued

XYZ is considering an alternative active strategy with the following overall portfolio allocation:

	Allocation
Index	60%
Active Manager C	40%

- (b) (1 point) Evaluate whether the reallocation is justifiable as an alternative active strategy.
- (c) (1 point) Characterize the structure of the portfolio of managers in parts (a) and (b), respectively.

To evaluate manager performance, XYZ collects the following information:

Manager	Manager's Normal Benchmark	Benchmark Annual Return
XYZ	MSCI World Index	10%
Active Manager A	MSCI World Value Index	11%
Active Manager B	MSCI World Growth Index	14%
Active Manager C	MSCI World Ex Japan Growth Index	15%

- (d) (2 points)
- (i) Calculate Manager B's "true" active return
- (ii) Calculate Manager C's "misfit" return
- (e) (1 point) Describe one advantage and one disadvantage of using the Completeness Fund approach to build a portfolio of multiple active managers.

**15.** (4 points) An equity investment company is evaluating an investment manager's performance of managing an equity fund that consists of 4 stocks.

(a) (1 point) Describe four choices that determine an equity index's characteristics.

The stocks in the equity fund are listed below.

Stock	Share Price December 2016	Share Price December 2017	Number of Shares	Free float factor
A	12	20	100	1
B	8	15	50	1
C	10	10	10	0.5
D	40	10	20	0.5

(b) (2 points)

- (i) Calculate the 1-year price-only return as of December 2017 under price weighting, value weighting, float weighting, and equal weighting.
- (ii) Describe the potential bias under each weighting method and recommend the appropriate index weighting method.

Now assume that the contract states float weighting is used for the equity fund. The portfolio generates return of 46% for 2017.

	Manager's Portfolio	Equity Index Benchmark
Dividend Yield	1%	2%
P/E	25	20
P/B	2.5	2
Earning per Share Growth	15%	10%
<i>Sector Exposure %)</i>		
Health Care	25%	25%
Finance	25%	25%
IT	50%	25%
Utilities	0%	25%

(c) (1 point) Identify the fund manager's investment style and comment on the performance.

**16.** (5 points) You are reviewing the Investment Policy Statement (IPS) for XYZ, a US based insurance company that underwrites and markets life insurance and annuity products in the U.S., Japan, and Canada. You collect the following information:

- XYZ has \$50 billion total assets and \$500 million surplus.
- Average durations of assets and liabilities are 12 and 13, respectively.
- A small portion of the XYZ asset portfolio is invested in private placement bonds and commercial mortgage loans.
- Interest rates have declined quite significantly since the last review of the IPS.
- Due to increased peer competition, XYZ recently increased the rate being credited to its interest-rate-sensitive products while maintaining the rate credited to its interest-rate-insensitive products.
- XYZ has a new investment mandate to grow surplus and support expanding business volume.
- U.S. Congress has reduced corporate tax rate from 35% to 21%.

(a) (1.5 points) Assess the impact of the above information on the risk objectives of XYZ with respect to the following considerations:

- Valuation concerns
- Reinvestment risk
- Cash-flow volatility

(b) (0.5 points) Recommend return objectives for XYZ in response to the recent developments.

(c) (1 point) Recommend two ways to achieve the return objectives of XYZ that you recommended in part (b).

(d) (1 point) Assess XYZ's liquidity requirements with respect to asset marketability risk.

(e) (1 point) Assess XYZ's tax concerns.

**\*\*END OF EXAMINATION\*\***  
**Afternoon Session**

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