The Infinite Actuary's

Practice Questions and Solutions for the

QFI Quant Exam

Zak Fischer, FSA CERA

Ken Qian, FSA

1. (7 points = 21 minutes)

Company XYZ's balance sheet currently consists of the following:

- Liabilities of 15-year annuities that make annual payments to company XYZ's policyholders
- Assets that are invested in short-term bonds with maturities ranging from 1 to 3 years
- The present value of XYZ's assets are equal to XYZ's liabilities

Company XYZ is concerned about interest rates decreasing. To better align the duration of the company's assets and liabilities, one analyst recommends that the company invest in 20-year floating rate bonds. He believes that the long maturity of these bonds should help protect the company against a decline in interest rates. The floating rate bonds have the following characteristics:

- Makes coupon payments semi-annually, with the first payment occurring in six months
- The coupon payments are linked to the 3-month LIBOR rate
- The floating rate bond has no spread

(a) (1 point) Calculate the duration of the 20-year floating rate bond

(b) (1 point) Assess the analyst's recommendation

(c) (1 point) Suggest another derivative security XYZ could transact in to align the duration profile of its balance sheet

A year has passed, and XYZ has modified its asset portfolio to be invested in longer duration bonds. However, as a result, the firm's balance sheet is now net positive duration, and faces risk of losing equity if interest rates increase. Your manager wants you to perform a value-at-risk analysis to learn about the potential losses the firm's asset portfolio could face if interest rates increased.

- Suppose your firm's assets are currently worth $20 million, and they are all invested in a bond portfolio with duration $D_P = 23$
- Assume that the monthly change in interest rates is normally distributed with a mean of 0.0074 and standard deviation of 0.0092

(d) (2 points) Calculate the 95% one-month VaR of the asset portfolio

After reading about your analysis from part (d), your manager says: *"Thank you so much for the information. Now that we have quantified the VaR of our asset portfolio from interest rates increasing, we have complete knowledge of our asset portfolio's risk profile"*

(e) (1 point) Critique your manager's statement

(f) (1 point) Propose an alternative to using VaR for analyzing the potential loss in the bond portfolio's value from an increase in interest rates

