**The maximum mark is 100. Full marks may be obtained for complete answers to FIVE questions out of SIX.**

1. Compute the PV of the following fixed-income securities with face value of $1,000 using a stated annual federal funds interest rate of 3% with a range of compounding periods.

1. Treasury bill (a risk-free bond with zero coupon) to be matured within one year, annually compounding. (5 marks)
2. ABC Corporate bond to be matured within 3 years, with a credit spread of +100 BP, making semiannual coupon payment of $20, semiannually compounding on Jun-30 and Dec-30. (5 marks)
3. If the federal funds interest rate is hiked to 4% immediately after the purchasing of the security, calculate the profit & loss (P&L) of an investor who decide to buy-and-hold the Treasury bill. (5 marks)
4. If the federal funds interest rate is cut to 2%, calculate the P&L of an investor who decide to sell the corporate bond now. (5 marks)

2. Consider an 8-year, annual-pay 4%, A+ rated bond trading on January 1, 2024 with YTM of 3.8524%. The bond is callable according to the following schedule:

* + Callable at 102 on or after January 1, 2029 (first call).

1. Calculate the bond’s price, (5 marks)
2. yield-to-first call, (5 marks)
3. yield-to-worst. (5 marks)
4. Consider the following market yields:
   * 8-year, U.S. Treasury bond, YTM 3.10%
   * 9-year, U.S. Treasury bond, YTM 3.26%
   * 10-year U.S. Treasury bond, YTM 3.43%
   * 10-year, A+ rated corporate bond, YTM 4.14%

Estimate the required yield on a newly issued 9-year, A+ rated corporate bond. (5 marks)

3. A pension fund manager with AUM (asset under management) of $100 million is considering a mutual fund’s return with µ = 10.5% and σ = 15%,

1. what is the probability that the return will be -14.7% or less? (5 marks)
2. If the risk-free rate is 3%, and the excepted market portfolio return is with µ = 9.1% and σ = 12%, according to the capital market line, we should buy the mutual fund or not? (5 marks)
3. If this manager has a minimum acceptable end-of-year AUM value of $102 million. He is considering two other assets: treasury bill with µ = 3.2% and σ = 1.4%, and corporate bond with µ = 5.5% and σ = 3.2%. According to the Roy’s safety-first criterion, which asset is the most desirable one? (5 marks)
4. If the manager has decided to construct the following portfolio, calculate the expected return and the standard deviation of the portfolio, assuming the returns of the assets are independent. (5 marks)

|  |  |  |
| --- | --- | --- |
| Mutual fund | Treasury bill | Corporate bond |
| 30% | 20% | 50% |

Note: The 90% confidence interval is [-1.65, +1.65].  
The 95% confidence interval is [-1.96, +1.96].  
The 99% confidence interval is [-2.58, +2.58].

4. Mr. Peter Lynch wants to use the CAPM model with S&P 500 as the benchmark to explain the variation in EXCESS returns on ABC common stock. The risk-free interest rate is 2%.

1. Write down the formula of the CAPM model. (5 marks)
2. Compute the beta for the ABC common stock using the following information. (5 marks)

|  |  |
| --- | --- |
| Excess return deviations: | Expected absolute return means: |
| Cov(S&P 500, ABC) = 0.000 506 | Mean(S&P 500) = 4.2% |
| Var(S&P 500) = 0.000 416 | Mean(ABC) = 7.1% |

1. If the Total sum of squares (SST) is 20,005 and the Sum of squared error (SSE) is 11,421, what is the coefficient of determination (R2) of this linear regression. (5 marks)
2. Compute the M2 alpha of the ABC common stock. (5 marks)

5. Consider a one-year zero-coupon bond.

1. What is the Macaulay duration of this bond? (5 marks)
2. If the YTM of this bond is decided by risk premium (220BP) and inflation (1.3%), if the risk-free rate is 3.5%, what is the modified duration of this bond? (5 marks)
3. Calculate the money duration if an investor has $10 million position of this zero-coupon bond. (5 marks)
4. Calculating the price value of a basis point. (5 marks)

6. ABC common stock is currently traded at $40.00 per share.

1. If a speculator buys a 6-month, $40 put option of ABC common stock with a premium of $0.7, what is the profit of this speculator if the ABC common stock’s price decline to $35 after 6 months?
2. Theoretically, what is the possible maximum profit of a put option holder? (consider the upper bound of a put option price)
3. If the risk-free interest rate is 2%(annually), estimate the premium of a 6-month, $40 call option using the put-call parity.
4. Estimate the contract price of a 6-month forward contract. If a speculator buys a 6-month forward contract of ABC common stock now, what is the profit or loss if the ABC common stock’s price rises to $45 after 3 months?