

SESSION 1 (132 minutes)

120 points

Item sets: read each vignette, then answer its four multiple-choice questions (3 points each). Choose the best of the three options (A, B or C). Essay (constructed response) sets: 12 points each. Show your calculations and give brief reasons; calculations that are shown are marked even if the final answer is wrong.

Question 1 (12 marks)

Hana is an adviser at Summit Wealth. A client portfolio is split between a global equity fund (weight 40%) and a bond fund (weight 60%). Capital market assumptions: equity expected return 8.0%, standard deviation 22%; bonds expected return 3.5%, standard deviation 8%; correlation between the two funds 0.2; risk-free rate 2.0%.

(1) What is the portfolio's expected return?

- A. 5.30%
- B. 5.75%
- C. 6.20%

[3 marks]

(2) What is the portfolio's standard deviation?

- A. 10.83%
- B. 10.02%
- C. 13.60%

[3 marks]

(3) What is the portfolio's Sharpe ratio?

- A. 0.24
- B. 0.30
- C. 0.49

[3 marks]

(4) If the correlation between the funds rose to 0.9 (all else unchanged), the portfolio standard deviation would be closest to:

- A. 10.83%
- B. 10.02%
- C. 13.29%

[3 marks]

Question 2 (12 marks)

Mira manages the Kestrel Pension Plan. Assets are \$400m with modified duration 6.5; the present value of liabilities is \$421m with modified duration 9.0. Assume duration estimates hold for a parallel shift of 1 percentage point in the discount rate and the yield curve.

(1) The plan's funded ratio is closest to:

- A. 95.0%
- B. -5.0%
- C. 105.2%

[3 marks]

(2) The plan's surplus (deficit) is closest to:

- A. -\$21m
- B. \$400m
- C. \$21m

[3 marks]

(3) If interest rates rise by 1 percentage point, the surplus will change to:

- A. -\$47.0m
- B. -\$9.1m
- C. \$16.9m

[3 marks]

(4) The asset duration needed to immunize the surplus against small parallel rate changes is closest to:

- A. 8.55
- B. 9.47
- C. 9.00

[3 marks]

Question 3 (12 marks)

Leila is a portfolio manager at Bluewater Investments running an active equity strategy. Over the past year the portfolio beat its benchmark by 2.0% with tracking error of 4.0%. The manager's information coefficient is 0.08, the strategy makes 64 independent bets a year and the transfer coefficient is 0.7.

(1) The realized information ratio is closest to:

- A. 0.33
- B. 2.00
- C. 0.50

[3 marks]

(2) The expected information ratio from the fundamental law (with transfer coefficient) is closest to:

- A. 3.58
- B. 0.45
- C. 0.64

[3 marks]

(3) To double the expected information ratio by changing breadth only, the number of independent bets must become:

- A. 256
- B. 128
- C. 72

[3 marks]

(4) If constraints are relaxed so the transfer coefficient rises to 0.8 (other inputs unchanged), the expected information ratio becomes closest to:

- A. 4.10
- B. 0.51
- C. 0.45

[3 marks]

THE WORKED ANSWERS TO THOSE 3 QUESTIONS

Question 1 (12 marks) [Asset Allocation]

Hana is an adviser at Summit Wealth. A client portfolio is split between a global equity fund (weight 40%) and a bond fund (weight 60%). Capital market assumptions: equity expected return 8.0%, standard deviation 22%; bonds expected return 3.5%, standard deviation 8%; correlation between the two funds 0.2; risk-free rate 2.0%.

(1) What is the portfolio's expected return? A. 5.30% B. 5.75% C. 6.20%

(1) Answer: A. 5.30%

- $E(R_p) = w_1 \times E(R_1) + w_2 \times E(R_2) = 0.40 \times 8.0\% + 0.60 \times 3.5\% = 5.30\%$.

KEY TAKEAWAY

Expected return is the weighted average of the asset expected returns.

(2) What is the portfolio's standard deviation? A. 10.83% B. 10.02% C. 13.60%

(2) Answer: A. 10.83%

- Variance = $(w_1 s_1)^2 + (w_2 s_2)^2 + 2 w_1 w_2 \rho s_1 s_2 = 0.007744 + 0.002304 + 0.001690 = 0.011738$, so standard deviation = $\sqrt{0.011738} = 10.83\%$.

KEY TAKEAWAY

Portfolio risk needs the correlation term; ignoring it overstates or understates risk.

(3) What is the portfolio's Sharpe ratio? A. 0.24 B. 0.30 C. 0.49

(3) Answer: B. 0.30

- Sharpe = $(E(R_p) - R_f) / \sigma_p = (5.30\% - 2.0\%) / 10.83\% = 0.30$.

KEY TAKEAWAY

Sharpe ratio = excess return per unit of total risk.

(4) If the correlation between the funds rose to 0.9 (all else unchanged), the portfolio standard deviation would be closest to: A. 10.83% B. 10.02% C. 13.29%

(4) Answer: C. 13.29%

- Recompute the variance with $\rho = 0.9$: $0.007744 + 0.002304 + 0.007603 = 0.017651$, so standard deviation = $\sqrt{0.017651} = 13.29\%$, which is higher than 10.83%.

KEY TAKEAWAY

A higher correlation reduces diversification and raises portfolio risk.

LOS: Mean-variance portfolio of equity and bonds (Asset Allocation)

Question 2 (12 marks) [Asset Allocation]

Mira manages the Kestrel Pension Plan. Assets are \$400m with modified duration 6.5; the present value of liabilities is \$421m with modified duration 9.0. Assume duration estimates hold for a parallel shift of 1 percentage point in the discount rate and the yield curve.

(1) The plan's funded ratio is closest to: A. 95.0% B. -5.0% C. 105.2%

(1) Answer: A. 95.0%

- Funded ratio = assets / liabilities = $400 / 421 = 95.0\%$.

KEY TAKEAWAY

Funded ratio compares assets to the present value of liabilities.

(2) The plan's surplus (deficit) is closest to: A. -\$21m B. \$400m C. \$21m

(2) Answer: A. -\$21m

- Surplus = assets - liabilities = $400 - 421 = -\$21m$.

KEY TAKEAWAY

Surplus is the gap between asset value and liability value.

(3) If interest rates rise by 1 percentage point, the surplus will change to: A. -\$47.0m B. -\$9.1m C. \$16.9m

(3) Answer: B. -\$9.1m

- Change in assets = $-6.5 \times 400 \times 1\% = -\$26.0m$; change in liabilities = $-9.0 \times 421 \times 1\% = -\$37.9m$; new surplus = $-\$9.1m$.

KEY TAKEAWAY

Liabilities with the longer duration lose more value when rates rise; the surplus moves by the difference.

(4) The asset duration needed to immunize the surplus against small parallel rate changes is closest to: A. 8.55 B. 9.47 C. 9.00

(4) Answer: B. 9.47

- Match dollar duration: $D_{\text{assets}} \times A = D_{\text{liab}} \times L$, so $D_{\text{assets}} = 9.0 \times 421 / 400 = 9.47$.

KEY TAKEAWAY

To hedge the surplus, match the dollar duration of assets and liabilities, not just the durations.

LOS: Asset-liability management for a pension plan (Asset Allocation)

Question 3 (12 marks) [Portfolio Construction]

Leila is a portfolio manager at Bluewater Investments running an active equity strategy. Over the past year the portfolio beat its benchmark by 2.0% with tracking error of 4.0%. The manager's information coefficient is 0.08, the strategy makes 64 independent bets a year and the transfer coefficient is 0.7.

(1) The realized information ratio is closest to: A. 0.33 B. 2.00 C. 0.50

(1) Answer: C. 0.50

- $IR = \text{active return} / \text{tracking error} = 2.0\% / 4.0\% = 0.50.$

KEY TAKEAWAY

Information ratio = active return per unit of active risk.

(2) The expected information ratio from the fundamental law (with transfer coefficient) is closest to: A. 3.58 B. 0.45 C. 0.64

(2) Answer: B. 0.45

- $IR = TC \times IC \times \sqrt{BR} = 0.7 \times 0.08 \times \sqrt{64} = 0.45.$

KEY TAKEAWAY

The fundamental law: $IR = TC \times IC \times \text{square root of breadth}.$

(3) To double the expected information ratio by changing breadth only, the number of independent bets must become: A. 256 B. 128 C. 72

(3) Answer: A. 256

- IR depends on $\sqrt{BR}$, so doubling IR requires 4 times the breadth: $4 \times 64 = 256.$

KEY TAKEAWAY

Because skill acts through the square root of breadth, doubling the IR needs four times as many bets.

(4) If constraints are relaxed so the transfer coefficient rises to 0.8 (other inputs unchanged), the expected information ratio becomes closest to: A. 4.10 B. 0.51 C. 0.45

(4) Answer: B. 0.51

- $IR = 0.8 \times 0.08 \times \sqrt{64} = 0.51.$

KEY TAKEAWAY

A higher transfer coefficient converts more of the manager's insight into portfolio weights.

LOS: Active management and the fundamental law (Portfolio Construction)

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