QUESTION 9 HAS FIVE PARTS (A, B, C, D, E) FOR A TOTAL OF 15 MINUTES

Heather Ramberg, a consultant to the board of directors of Reins Foundation, has been asked to analyze and recommend an asset allocation for Reins. Ramberg has read Reins's investment policy statement and found the following information:

Return objective: 8.5%.

Risk objective: Maximum standard deviation 10%.

To analyze the appropriate asset allocation, Ramberg produced data on the 5 corner portfolios shown in Exhibit 1.

Exhibit 1: Data on Five Corner Portfolios

Corner Portfolio	Expected Return (%)	Expected Standard Deviation (%)	Sharpe Ratio	Portfolio Weights, in %			
				U.S. Equities	Foreign Equities	Global Bonds	U.S. Real Estate
1	10.2	14.1	0.5106	0.0	100.0	0.0	0.0
2	10.1	13.6	0.5221	42.7	57.3	0.0	0.0
3	9.7	12.1	0.5537	41.3	38.7	20.0	0.0
4	8.2	9.0	0.5778	38.4	12.9	36.7	12.0
5	7.8	8.9	0.5506	37.4	11.9	39.7	11.0

Risk-free rate = 3.0%

A. **Calculate** the *most appropriate* weight for U.S. equity for the foundation based on the corner portfolio theory and meeting the required return target. **Show** your work.

(4 minutes)

B.   **Estimate** the standard deviation of the *most appropriate* portfolio for the foundation, based on the corner portfolio theory. **Show** your work. **State** whether the actual sigma will be higher or lower than the estimate.

(3 minutes)

C.   Using data from Exhibit 1 and assuming that short selling (leverage) or investing at the risk-free rate is appropriate, **determine** which corner portfolio or portfolios would *most likely* be selected. Provide one reason to support your selection.

(2 minutes)

D.   **Explain** whether it is *most appropriate* for the foundation to construct its portfolio from two corner portfolios or from one corner portfolio plus leverage or borrowing.

(2 minutes)

Ramberg wants to present alternative approaches to traditional mean variance optimization and to using corner portfolios at the next board meeting. In preparation, he gathers information on alternatives.

E.   **Explain** the *most serious* problem with MVO and **explain** how resampling is used to address this problem.

(4 minutes)

QUESTION 9

Source: Study Session 8, LOS 17.i, r

A.   CPs 3 and 4 will bracket the required return of 8.5%.
      Solve for the weighting: $8.5 = 9.7(w_3) + 8.2(1 − w_3)$: $w_3 = 20\%$ and $w_4 = 80\%$
      U.S. eq = 0.2(41.3%) + 0.8(38.4%) = 8.26% + 30.72% = 38.98%

      Candidate discussion: 1 point for using CPs 3 and 4, 1 point for their weights, and 2 points for the correct U.S. equity allocation.

B.   Standard deviation = 0.2(12.1%) + 0.8(9.0%) = 9.62%. The actual sigma will be lower because the diversification benefit of less than +1 correlation was ignored.

      Candidate discussion: 1 point for using the correct weights (the same ones as in the previous part). 1 point each for the correct sigma calculation and stating lower. No explanation for why lower was required for the last point.

C.   Use CP 4.

      CP 4 has the highest Sharpe ratio; therefore, any combination of CP 4 and the risk-free asset will also have a higher Sharpe ratio than combinations of risk-free and any other CP. It will also have a higher Sharpe ratio than any combination of CPs.

      Candidate discussion: 1 point each for CP 4 and the explanation. Given the low number of minutes assigned, a simple statement that it has the highest Sharpe ratio is sufficient.

D.   A foundation is ongoing. It has no one discrete time period to consider and no true risk-free asset (0 standard deviation) exists to borrow or lend at. Use two CPs.

      Candidate discussion: 1 point each for stating use two CPs and for the explanation. Any clear indication the candidate is aware of the foundation's multi-period nature or lack of a true risk-free asset was acceptable for the 1 point explanation.

E.   The instability of the efficient frontier is the most serious problem. Asset class returns are difficult to estimate accurately, and small changes in estimates may produce large shifts in the appropriate asset allocation.

      Resampling addresses this by forecasting a range of possible returns around the initial single point estimate. Each set of estimates produces a different frontier and asset allocation for a given return. An average asset allocation is then used from the multiple sets of assumptions. This allocation is less sensitive to additional changes in asset class return estimates.

      Candidate discussion: 2 points for addressing the most serious problem. Some explanation of why it is an issue is needed for 2 points. The problem can also be discussed in terms of MVO typically selecting a small number of asset classes. 2 points for explaining how resampling works to address the problem.