Question 1: Portfolio Management **(49 points)**

You are the regional manager overseeing the portfolio management teams in multiple small countries. All returns in the following questions are simple returns.

a) The portfolio manager from country Aldonia would like to combine a risky stock with government-issued bills that can serve as risk-free assets in the country.

a1) If the risky asset has an expected rate of return of 10% and a standard deviation of 19% and the government-issued bill has a rate of return of 4%, calculate the slope of the Capital Allocation Line (CAL) formed with the risk-free asset and the risky asset. (2 points)

a2) The portfolio manager aims to maintain a systematic risk level for the overall portfolio that matches the market's risk level. The beta of the risky stock is 1.4. What proportion of the portfolio should be invested in the Government bills? (3 points)

b) The market of country Balonia comprises 2 investable stocks as per your screening criteria. The return on the risk-free asset is R= 1%. Table 1 below presents the predicted returns in the next period of the two stocks, Argist and Boost, in three different scenarios. The covariance between the 2 stocks is –0.00016.

Table 1: The expected returns of the stocks Argist and Boost

Scenario	R_{Argist}	R_{Boost}	Probability
Good	10%	0.5%	25%
Moderate	5%	1.0%	50%
Bad	–3%	1.5%	25%

b1) Calculate the expected returns and standard deviations of stocks Argist and Boost. (8 points)

b2) Calculate the correlation coefficient between Argist and Boost's returns.
[Note: In case you have not solved question b1) use the value of standard deviation of returns as 0.0480 and 0.0034 for Argist and Boost, respectively.] (2 points)

c) In the country of Calbania, the portfolio manager is researching two mutual funds for potential investment. The expected returns by the portfolio manager and beta of the funds are shown in Table 2 below:

Table 2: Mutual funds of Calbania

	Fund A	Fund B
Expected return (annualized)	13%	11%
Beta	1.4	0.7

The expected return on the market portfolio is 11% and its standard deviation is 15%. The risk-free rate is 5%.

c1) Suppose you want to select a mutual fund that you expect to perform better than the market portfolio in terms of CAPM alpha or Treynor ratio. Which mutual fund would you choose to invest in? Show your calculations and briefly justify your choice. (5 points)

c2) Suppose you currently hold the market portfolio. Additionally, assume you could sell the market portfolio and invest your money in either Fund A or Fund B, along with the risk-free asset, to improve the return for the same systematic risk. What would the composition of the new portfolio be? Compare the expected return of the new portfolio with the market.
[Hint: You can borrow at the risk-free rate.] (6 points)

d) In the country of Domania, the risk-free rate is 2%, the expected market risk premium is 7%, and the standard deviation of the market return is 20%. Asset Argon has a beta of 1.2 and Asset Boron has a beta of 0.8 with respect to the market, as per the CAPM.

d1) A client is considering investing in the 2 assets, 60% in Argon and 40% Boron. Calculate the expected return of the portfolio and the amount of systematic risk in the portfolio (i.e., the standard deviation of portfolio returns attributable to the market factor). (6 points)

d2) Another client wishes to invest in a portfolio that generates an expected return of 15%. Using CAPM, calculate the beta of this portfolio. Demonstrate how to construct such a portfolio that includes the assets Argon and Boron. Assume short selling is allowed. (6 points)

d3) You would like to evaluate the performance of two mutual fund managers. Table 3 below shows the data on their portfolios.

Table 3: Mutual funds of Domania

Fund	$E[R_i]$	$Cov[R_i, R_m]$	$\sigma(R_i)$
1	9%	0.035	17.5%
2	13%	0.045	33%

(i) Calculate the Sharpe ratios of the two funds separately. (2 points)

(ii) Calculate the Jensen's alphas of the two funds separately. (3 points)

(iii) Assume you are a mean-variance investor. You can lend and borrow at the risk-free rate (2%). If you wish to invest only in one of the two funds, which measure would you use to choose between the two? And which fund would you pick? Explain briefly. (3 points)

d4) You are considering a third asset, Neon, that has an expected return $E[R_{Neon}] = 9\%$, and a CAPM beta of 1.25. Is Neon correctly priced? Explain. (3 points)