Question 1: Portfolio Management (40 points)

You are a junior portfolio manager at Alpinum Inc., an asset management company founded three years ago. Alpinum Inc. specializes in stock analysis and conducts a lot of research in portfolio management and the valuation of individual stocks. Alpinum Inc. has developed its own quantitative models to identify undervalued stocks and invest in them through a pure long-only equity fund.

Alpinum Inc.'s quantitative process involves several steps. The starting point is a monitoring list of promising stocks, which are then analysed in detail in the next step. All stocks on the monitoring list are generally deemed investable.

Thanks to successful stock selections in the past, Alpinum Inc. has significantly increase its assets under management and acquired new clients. The company's objective is to continue expanding its assets under management.

Therefore, your team leader assigned you to perform some calculations on stocks currently listed on Alpinum Inc.'s monitoring list. Consider the risk-free rate is 0.5% p.a. and the stocks do not pay any dividends during the year. Table 1 below provides key information about these stocks:

Beta: beta to Swiss Market Index (SMI), P_0: present price, P_1: price after 1 period (or year)

Table 1: Information on equity monitoring list from Alpinum Inc.:

	Stock A	Stock B	Stock C	Swiss Market Index (SMI)
Beta	0.6	1.2	0.4	1.0
P_0 (CHF)	48.25	18.50		
P_1 (forecast) (CHF)	54.85	21.20	18.10	
Standard deviation of returns	9.5%	8.5%	7.5%	6.0%
Expected market return (SMI)				5.0% p.a.

Source: Bloomberg Finance L.P.

a) You are asked to assess the valuation based on the information in Table 1.

a1) How do you define and measure each stock's exposure to Swiss market (SMI) returns? Provide the correct formula for calculating the exposure and explain its components and implications. How do you interpret this exposure when its value is greater than or less than 1? (3 points)

a2) Calculate the beta of a portfolio consisting of the 3 stocks A, B and C. Assume all 3 stocks are equally weighted. Does this portfolio have larger systematic risk than the Swiss Market Index (SMI)? (2 points)

a3) What is the link between the Security Market Line (SML) and the Capital Market Line (CML)? Are all efficient portfolios of the CML also located on the SML? (2 points)

a4) Use the CAPM model to check if stock B is correctly valued or if it is above or below the Security Market Line (SML). Based on your calculations, would you buy the stock? (3 points)

a5) To check if stock A is mispriced, plot a chart in graph 1 with the Security Market Line (SML) and indicate Stock A and label the axes in your graph. (5 points)

Graph 1: Security Market Line

b) Some of the new investors are asking questions about decomposition of the risk of individual shares and are interested in the decomposition of the variance. Calculate the idiosyncratic risk (in standard deviation) of Stock A. (3 points)

Next you analyse the stock returns using the following three-factor model. The information on factor model is shown in Table 2.

$$R_i = 2\% + 0.4 \cdot F_1 + 1.2 \cdot F_2 + 0.9 \cdot F_3 + \varepsilon$$

Table 2: Information on factor model:

Factors	F_1	F_2	F_3
Expected Factor Returns	$E(F_1) = 5.0\%$	$E(F_2) = 3.0\%$	$E(F_3) = 2.0\%$
Std. Deviations of Factors	$\sigma_{F1} = 11\%$	$\sigma_{F2} = 8\%$	$\sigma_{F3} = 10\%$

c) Calculate the expected return and the standard deviation of share i using the three-factor model above. Assume that ε in the factor model has a mean of zero and a standard deviation of 10.0%. The 3 factors and ε are uncorrelated with each other. (5 points)

The management of Alpinum Inc. is also considering if adding alternative investments to its portfolio would be beneficial. Until now, the company's philosophy has been to invest only in equities. For this reason, you have been asked to evaluate individual investments within alternative investments.

d) Private equity investments are of particular interest, as several recent studies suggest that private equity investments have generated excess returns compared to traditional investments.

d1) Provide 2 possible explanations for the apparent superior performance of private equity investments. (4 points)

d2) Assuming you conclude that private equity is a worthwhile investment, describe 2 possible methods for investing in private equity. Explain each method. (4 points)

d3) The typical net cumulative cash flow pattern of private equity funds is often referred to as the J-curve. Identify and explain any 1 factor that amplifies this J-curve effect. (2 points)

d4) Identify and explain a major drawback of private equity funds resulting from their organizational structure. (2 points)

Another client is currently considering adding an Exchange-Traded Fund (ETF) to its equity portfolio to reduce the risk. Alpinum Inc. recommends the Global Star ETF, issued by a local investment bank. It is important to note that the ETF's returns vary depending on the economic environment (Table 3):

Table 3: Information on Global Star ETF

State of the economy	Return of Global Star ETF
Peak	6.0%
Contraction (Downward trend)	4.0%
Recession	1.0%
Expansion (Upward trend)	8.0%

e) According to the company's internal economic analysis, there is currently 70% probability that the global economy is in recession. However, it cannot be completely ruled out that the model is giving a false signal and that the recession has already ended, with the global economy now on an upward trend (expansion with 30% probability). Recent improvements in the Purchasing Manager Indices (PMI) in particular, which have exceeded expectations, support this possibility.

e1) Calculate the expected return of the Global Star ETF based on this information and Table 3. (2 points)

e2) The client intends to invest a total of CHF 100,000 allocating equal amounts in stock A and Global Star ETF. Calculate the standard deviation of this equally weighted portfolio, assuming that the standard deviation of the Global Star ETF is 6% and the covariance between stock A and Global Star ETF is 0.01. (3 points)