

Institute of Actuaries of India

Subject SP5- Investment and Finance

November 2023 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:

- i) While at the outset, the statement that ESG conscious investment with a limited portfolio set can outperform one without an ESG focus, there are some qualitative long term implications of ESG investments that the investor must take into consideration while considering the intrinsic value. ESG factors can affect the financial performance of investments through various channels such as:
- a) ESG focused companies can reduce costs through more efficient use of energy and raw materials
 - b) Companies without an ESG focus can potentially face higher costs if governments introduce or increase pollution taxes, penalties for social accountability violations such as work hours and overtime.
 - c) Additionally, companies higher up the value chain could prefer to place orders with ESG companies to boost their own reputation, differentiate their product to up-sell for a premium.
 - d) Lack of ESG focus can lead to a company suffering reputational damage if they are found to be involved in controversial practices such as modern slavery
 - e) Companies can perform better and recruit better talent if they have motivated staff enjoying good working conditions. It also leads to reduced attrition and better workplace culture.
 - f) On the flip side, lack of proper corporate governance can lead to a company under performing if the pay structures of executives are not aligned with shareholder's long-term interests.

[6]

ii)

- a) Lack of a strong independent board: for eg, independent directors being closely related to or benefiting from the executive directors of the company
- b) Lack of transparency: When a company does not provide adequate information about its operations, financial performance, or risks, it can lead to a lack of trust among investors and other stakeholders. This lack of transparency can make it difficult for stakeholders to make informed decisions about the company's future prospects, which can negatively impact its reputation and financial performance.
- c) Conflicts of interest: When the interests of a company's management or board of directors are not aligned with those of the company or its stakeholders, it can lead to decisions that prioritize personal gain over the long-term interests of the company. This can result in poor financial performance, damage to the company's reputation, and a loss of investor confidence.
- d) Poor risk management: When a company does not have adequate systems in place to identify, assess, and manage risks, it can lead to significant financial losses or other negative impacts. This can occur when a company takes on excessive debt, engages in risky investments or acquisitions, or fails to address emerging risks such as cyber threats or climate change.
- e) Fraud and corruption: When a company engages in fraudulent or corrupt practices, it can lead to significant financial losses, reputational damage, and legal consequences. This can include embezzlement, bribery, or accounting fraud.
Frequent auditor turnover

[3]

[9 Marks]**Solution 2:**

- i)
- a) By selling an at the money call option & put option while buying an out of the money call option & put option, the trader will pocket a net positive premium at the start of the contract

- b) The trader will benefit if stock price at expiry is within a specific range but he will lose out if the stock price breaks out of the range
- c) This strategy is called as a iron butterfly strategy and the trader is expecting a neutral outlook for the stock and the stock to be range bound in the given period of the contract

[2]

ii)



[3]

[5 Marks]

Solution 3:

- i) The cost of carry is the cost of holding a security or a physical commodity over a period of time. It includes insurance, storage and interest on the invested funds as well as other incidental costs [1]
- ii) A convenience yield is the benefit or premium associated with holding an underlying product or physical good, rather than the associated derivative security or contract. [1]
- iii) The relationship between spot price and futures can be explained by:

$$F = S \cdot \exp[(r+s-c) \cdot t]$$

where,

F = Futures Price

S = Spot Price

r = risk free rate

s = storage cost

c = convenience yield

t = time to expiry

Futures price should be monotonically increasing if $(r+s) > c$ and vice versa.

[3]

In this case, if the price of 3 months futures is more than the price of 12 month futures, then the cost of carry is lesser than the convenience yield.

This situation is referred to as backwardation. This situation usually arises in commodity market when there are supply side constraints and the asset is not available for immediate purchase in the spot market to meet demand.

In a state of backwardation, futures contract prices include compensation for the risk transferred from the underlying asset holder to the purchaser of the futures contract. This means the expected spot price on expiry is higher than the price of the futures contract.

iv)

- a) - In the domestic market, it could lead to a glut of availability in the spot market leading to increased storage cost and thus increased spread.
- In the international market, it could lead to shortage of the commodity leading to a situation of backwardation, thus leading to decreased or negative spread.
- b) Increase in repo rates will lead to an increase in cost of borrowing & hence increase in cost of carry. This will lead to the spread between futures and spot increasing.

[4]

[9 Marks]

Solution 4:

- a) Cash Price of the Bond:

$$= 18 * [\exp(-.05) + \exp(-.05 * 2) + \exp(-.05 * 3) + \exp(-.05 * 4) + \exp(-.05 * 5)] + 100 * \exp(-.05 * 5)$$

$$= 155.53$$

As there is no accrued interest, this is also the bond price at time 0.

- b) Present Value of Interest Paid During Lifetime of Call:

$$= 18 * [\exp(-.05)]$$

$$= 17.12$$

- c) Forward Price of the Bond = $(155.53 - 17.12) * \exp(.05 * 1.5) = 149.19$

- d) Duration of the Bond At Expiry:

$$.5 * 18 * \exp(-.05 * .5) + 1.5 * 18 * \exp(-.05 * 1.5) + 2.5 * 18 * \exp(-.05 * 2.5) + 3.5 * 118 * \exp(-.05 * 3.5)$$

$$18 * \exp(-.05 * .5) + 18 * \exp(-.05 * 1.5) + 18 * \exp(-.05 * 2.5) + 118 * \exp(-.05 * 3.5)$$

$$= 420.24 / 149.2$$

$$= 2.81 \text{ years}$$

- e) Bond Price Volatility:

$$= 2.81 * .25 * .05 = 3.52\%$$

- f) Price of Call Option:

$$d1 = [\log(149.19/135) + 1.5 * (.0352^2/2)] / (.0352 * (1.5)^.5) = 2.3398$$

$$d2 = 2.2968$$

$$\text{Value of Call} = P(0,T) * [F * n(d1) - X * n(d2)] = \exp(-.05 * 1.5) [149.19 * .99 - 135 * .989]$$

$$= 13.18$$

[10 Marks]

Solution 5:

- i)
- a) Default of corporate loans given by the bank
 - b) Default of investments held in reser/ves/debentures/government securities
 - c) Default by the counterparty of the OTC derivative contracts
 - d) Default by service providers where advance has been paid
- [2]

ii)

- a) Credit risk is the risk that a counter party to an agreement will be unable or unwilling to fulfil their obligations. Value at risk assesses the potential losses on a portfolio over a given future time period with a given degree of confidence.
- b) The first step will be in defining the sources of credit risk
- c) In this case, the biggest and the most prominent source of credit risk exposure will be the commercial loans given by the bank
- d) There are three aspects to modeling the credit risk from commercial loans – probability of default at various time periods, magnitude of loss given default and correlation between defaults
- e) For the distribution of timing of default, it could use the same probability of payment model that it used while pricing the loan, but with a conservative drift to account for the fact that this is for reserving and not pricing. This will be the most important variable in the model.
- f) The magnitude of loss is the amount due at the time of default. This can be calculated based on the amortization schedule.
- g) Correlation of losses is more difficult to estimate and in the case of commercial accounts, it will have to be subjective based on expert opinion.
- h) A model for recovery of these defaults should also be incorporated based on a “recovery given default” model.
- i) For instruments held or for OTC contracts, it could be based on historical data of similar instruments.
- j) If the bank does not have data to calibrate parameters of the VaR model, it could buy external data or take insights from external consultants who are likely to offer a neutral picture as against insiders doing this exercise.
- k) Once the model is defined, the defaults are simulated for each account and are aggregated together using the defined correlation model.
- l) Given this exercise is happening for the first time, it might be a good idea to get this vetted with an external agency to ensure the bank is on the right track.

[6]

[8 Marks]**Solution 6:**

- i) Cross sectional behavior of stocks [1]
- ii) High sentiment [1]
- iii) Noise trading [1]
- iv) Mental accounting [1]
- v) Self serving bias [1]

[5 Marks]

Solution 7:

i)

1. **Differential Tax Rates:** Different countries have varying tax rates on capital gains, dividends, and interest income. Investors should compare these rates between their home country and the international markets to understand the potential tax liabilities.
2. **Double Taxation Agreements (DTAs):** Check if there are DTAs between the investor's home country and the country of investment. DTAs can prevent double taxation of the same income in two different countries, potentially reducing the overall tax burden.
3. **Withholding Taxes:** Many countries impose withholding taxes on dividends and interest paid to foreign investors. Understanding these rates and how they interact with the investor's domestic tax obligations is crucial.
4. **Foreign Tax Credits:** Some countries offer tax credits for taxes paid on international investments. Investors should determine if they can claim foreign tax credits to offset their domestic tax liabilities.
5. **Estate and Inheritance Taxes:** If investing in international assets, it's important to understand the estate and inheritance tax laws of the country where the assets are located. These taxes can significantly impact the value of the investment for heirs.
6. **Tax Reporting Requirements:** Domestic and international investments often have different reporting requirements. Investors need to be aware of these to ensure compliance and avoid penalties.

[2]

ii)

While the intentions are commendable, this strategy could have several potential flaws and unintended consequences

1. **Reduced Foreign Investment:** Higher taxes on foreign income could deter foreign investors and multinational companies from investing in the country. This could lead to a reduction in foreign direct investment (FDI), which is often crucial for economic growth, technology transfer, and job creation.
2. **Capital Flight:** Domestic investors might move their capital to countries with more favorable tax regimes. This capital flight can lead to a decrease in domestic investment, negatively impacting economic growth.
3. **Competitiveness and Efficiency Issues:** Taxing foreign income more heavily could make domestic companies less competitive internationally. They might be less inclined to expand globally or may find it challenging to compete with foreign firms that enjoy lower tax burdens.
4. **Tax Evasion and Avoidance:** Higher taxes on foreign income could incentivize tax evasion and avoidance strategies. Individuals and corporations might use aggressive tax planning techniques to shift profits and minimize their tax liabilities, leading to a decrease in overall tax revenues.
5. **Distortion of Market Forces:** Providing tax breaks to start-up ventures, while beneficial in supporting entrepreneurship, could lead to market distortions. It might encourage the formation of start-ups not because of genuine market demand or innovation potential but merely to avail tax benefits.
6. **Resource Misallocation:** The focus on start-ups might lead to a misallocation of resources, with capital and talent flowing disproportionately into sectors that may not

be the most efficient or productive for the economy.

7. **Impact on International Relations:** Such a tax policy could strain the country's economic relations with its trading partners, potentially leading to retaliatory measures and impacting international trade.
8. **Inequality Concerns:** While the intention is to distribute wealth more evenly, the policy could inadvertently benefit a small segment of the population (e.g., tech-savvy entrepreneurs) at the expense of others, potentially exacerbating inequality in other areas.

[4]

[6 Marks]

Solution 8:

- i) Active management of a bond portfolio refers to a strategy where the portfolio manager makes **deliberate and ongoing decisions about buying, selling, and holding individual bonds or bond sectors** with the **goal of outperforming a specified benchmark index**. This approach contrasts with passive management, where the goal is to replicate the performance of a benchmark index, not to outperform it

[1]

ii) **Anomaly Switching:**

1. **Market Inefficiencies:** Focuses on exploiting temporary mispricings or anomalies in the bond market, such as those caused by overreactions or liquidity constraints.
2. **Research-Intensive:** Requires extensive market research and analysis to identify undervalued or overvalued bonds.
3. **Timing:** Success depends on the ability to accurately predict when the market will correct these anomalies.
4. **Risk Management:** Involves a higher level of risk, as it relies on the assumption that the market will eventually recognize and correct the mispricing.

Policy Switching:

1. **Economic Indicators:** Based on anticipating and responding to changes in macroeconomic conditions and central bank policies, such as interest rate adjustments.
2. **Portfolio Adjustment:** Involves altering the composition of the bond portfolio in response to expected changes in the economic environment.
3. **Duration Management:** May include adjusting the duration of the bond portfolio to manage interest rate risk.
4. **Proactive Strategy:** Requires a proactive approach to portfolio management, with continuous monitoring of economic trends and policy announcements.

[2]

iii) **Anomaly Switching**

1. **Price Ratios:**
 - **Definition:** Price ratios in bond portfolio management involve comparing the prices of different bonds relative to each other. This comparison often focuses on ratios like price-to-earnings (P/E) for corporate bonds, or price-to-par value for government bonds.
 - **Usage:** These ratios are used to assess whether a bond is overvalued or undervalued compared to its peers or historical averages. For instance, a bond with a low P/E ratio might be undervalued compared to similar bonds in the market.

2. Price Models:

- **Definition:** Price models are quantitative tools or algorithms that predict the future price of a bond based on various factors like interest rates, credit ratings, and economic indicators.
- **Usage:** These models help in forecasting bond prices under different market conditions. They can be complex, incorporating factors like embedded options, or simpler, focusing on fundamental bond characteristics. Portfolio managers use these models to make informed buy or sell decisions.

3. Yield Models:

- **Definition:** Yield models are analytical tools used to estimate the expected yield of a bond. These models take into account factors like the bond's maturity, coupon rate, current market yield, and the issuer's credit risk.
- **Usage:** Yield models are crucial for assessing the return on investment for a bond. They help in comparing the yields of different bonds, adjusting for factors like duration and credit risk. This comparison is vital for constructing a bond portfolio that aligns with the investor's yield expectations and risk tolerance.

Policy Switching

1. Volatility and Duration:

- **Definition:** Volatility and duration are measures used to assess the sensitivity of bond prices to changes in interest rates. Duration measures the average time it takes to receive all cash flows from a bond, weighted by the present value of those cash flows, while volatility refers to the degree of variation in a bond's price.
- **Usage:** These measures help in understanding how bond prices might react to changes in the interest rate environment. A higher duration generally indicates greater sensitivity to interest rate changes. Portfolio managers use these metrics to adjust their bond holdings, aiming to optimize the risk-return profile in different interest rate scenarios.

2. Reinvestment Rates:

- **Definition:** Reinvestment rates refer to the interest rates at which cash flows from a bond (like coupon payments) can be reinvested.
- **Usage:** The reinvestment rate is crucial for determining the actual yield and return of a bond investment over time. In a rising interest rate environment, higher reinvestment rates can enhance returns, while in a falling rate environment, they can reduce returns. Portfolio managers consider reinvestment rates when making decisions about buying or selling bonds, as well as in forecasting future returns.

3. Spot vs. Forward Rates:

- **Definition:** Spot rates are the current interest rates for different maturities, while forward rates are the expected future interest rates derived from current spot rates.
- **Usage:** The comparison between spot and forward rates helps in understanding market expectations about future interest rates. This information can be used to identify potential opportunities for gain by predicting the direction of

interest rate movements. For instance, if forward rates are higher than spot rates, it might indicate an expectation of rising interest rates. Portfolio managers use this information to adjust their bond holdings accordingly, such as by altering the duration or credit quality of the bonds in the portfolio.

[3]

iv) Analysis for Switch to Option a)

- **Yield Comparison:** The GRY of 1.70% for the XGB 3% June 2025 bond is slightly higher than the current bond's GRY of 1.60%. This indicates a marginally better yield.
- **Maturity:** Both bonds have a similar maturity date, with the alternative bond maturing a few months earlier.
- **Price:** The alternative bond has a lower clean price, which could mean a lower initial investment for the investor.
- **Anomaly Switch:** Ratio of two bond prices is $117.50/112.30 = 1.045$ (Ratios are expected to stable over time – very similar in characteristics)
- **Justification:** The investor might consider this switch if they prioritize a slightly higher yield and are indifferent to the slightly earlier maturity. The lower price also makes it a more accessible investment. **Switch to Option a):** Suitable for investors seeking a slightly better yield without significantly changing the maturity profile of their investment.

Option b) XGB 2.75% December 2040

- **Clean Price:** 100.20
- **GRY:** 2.75%
- **Maturity:** December 2040

Analysis for Switch to Option b):

- **Yield Comparison:** The GRY of 2.75% for the XGB 2.75% December 2040 bond is significantly higher than the current bond's GRY of 1.60%. This suggests a much better yield.
- **Maturity:** This bond has a much longer maturity date (15 years later) compared to the current bond.
- **Price:** The price is lower than the current bond, indicating a lower entry point for investment.
- **Justification:** The investor might consider this switch if they are seeking a higher yield and are comfortable with the longer duration, which implies more exposure to interest rate risk and potentially higher price volatility. **Switch to Option b):** More appropriate for investors who are willing to accept longer-term bonds for a considerably higher yield, acknowledging the increased risks associated with a longer duration.
- **Policy Switch:** Investor is switching to a longer and more volatile bond.
- **Yield Expectations:** Investors expect yields in the market to fall and prices to increase. If this happens, all bonds will increase in price, but the long duration bonds will rise further giving rise to a profit.

[6]

[12 Marks]

Solution 9:**i) Sharpe Ratio Calculation**

The Sharpe Ratio is calculated using the formula:

$$\text{Sharpe Ratio} = (R_p - R_f) / \sigma_p$$

Where R_p is the average return of the portfolio, R_f is the risk-free rate (3%), and σ_p is the standard deviation of the portfolio's returns.

Mean of Fund 1 Returns (2.6%), SD of Fund 1 returns (8.73%)

Mean of Fund 2 Returns (3.9%), SD of Fund 1 returns (4.93%)

Sharpe Ratio of Fund 1 = $(2.6\% - 3\%) / 8.73\% = -0.0458$

Sharpe Ratio of Fund 2 = $(3.9\% - 3\%) / 4.93\% = 0.1825$

Treynor Ratio

The Treynor Ratio measures the excess return per unit of systematic risk (beta). It is calculated as:

$$\text{Treynor Ratio} = (R_p - R_f) / \beta_p$$

Where β_p is the beta of the portfolio.

Beta for Fund 1 = $\text{Cov}(\text{Fund 1, Benchmark}) / \text{Var}(\text{Benchmark}) = -1.579$

Beta for Fund 2 = $\text{Cov}(\text{Fund 1, Benchmark}) / \text{Var}(\text{Benchmark}) = -0.737$

Treynor Ratio of Fund 1 = $(2.6\% - 3\%) / -1.579 = 0.253$

Treynor Ratio of Fund 2 = $(3.9\% - 3\%) / -0.737 = -1.221$

Jensen's Alpha

Jensen's Alpha measures the average return of the portfolio over the expected return based on the CAPM model. It is calculated as:

$$\text{Jensen's Alpha} = R_p - (R_f + \beta_p(R_m - R_f))$$

Where R_m is the average market return.

Jensen's alpha for Fund 1 = 2.442%

Jensen's alpha for Fund 2 = -1.331%

Information Ratio

The Information Ratio measures the excess return of the portfolio over the benchmark per unit of risk (standard deviation of the difference in returns). It is calculated as:

$$\text{Information Ratio} = (R_p - R_b) / \sigma_{p-b}$$

Where R_b is the return of the benchmark and σ_{p-b} is the standard deviation of the portfolio's return minus the benchmark's return.

Mean of Benchmark Returns (4%),

σ_{p-b} of Fund 1 Returns (9.69%), σ_{p-b} of Fund 2 returns (5.90%)

Information Ratio of Fund1 = -0.145

Information Ratio of Fund 2 = -0.017

[7]

ii) Fund 1

- **Sharpe Ratio (-0.0458):** This negative Sharpe Ratio indicates that Fund 1 is underperforming relative to the risk-free rate when considering its volatility. A negative Sharpe Ratio is generally seen as unfavorable.
- **Treynor Ratio (0.253):** A positive Treynor Ratio suggests that Fund 1 is providing some excess return over the risk-free rate when considering its market risk (beta). However, the negative beta value is unusual and might indicate a contrarian or defensive position relative to the market.
- **Jensen's Alpha (2.442%):** A positive Jensen's Alpha indicates that Fund 1 has performed better than predicted by the CAPM model, suggesting good management performance.
- **Information Ratio (-0.145):** This negative Information Ratio suggests that Fund 1 is underperforming compared to the benchmark when considering the additional risk taken.

Fund 2

- **Sharpe Ratio (0.1825):** This positive Sharpe Ratio indicates that Fund 2 is providing excess return over the risk-free rate, considering its volatility. This is generally seen as favorable.
- **Treynor Ratio (-1.221):** The negative Treynor Ratio is concerning and suggests that Fund 2 is not providing adequate excess return for its market risk.
- **Jensen's Alpha (-1.331%):** A negative Jensen's Alpha indicates that Fund 2 has underperformed relative to the CAPM model's predictions, suggesting less effective management performance.
- **Information Ratio (-0.017):** This slightly negative Information Ratio suggests that Fund 2 is almost in line with the benchmark when considering the additional risk taken, but slightly underperforming.

Investment Decision

- **Risk-Adjusted Performance:** Fund 2 seems to have a better risk-adjusted performance than Fund 1, as indicated by its positive Sharpe Ratio.
- **Market Risk:** Fund 1's negative beta is unusual and might indicate a defensive strategy, which could be appealing in volatile or declining markets.
- **Management Performance:** Fund 1 has a higher Jensen's Alpha, suggesting better management performance in generating excess returns.
- **Consistency and Risk-Adjusted Performance:** Both funds are underperforming their respective benchmarks when considering the risk taken. However, Fund 2 is doing so to a lesser extent than Fund 1. This might indicate that Fund 2's management is more consistent or effective in managing risk relative to the benchmark, even though it is not generating significant excess returns.

[2]

[9 Marks]

Solution 10:

i)

- **Objective:** Align investment portfolio with anticipated future liabilities.

- **Risk Management:** Aims to reduce the risk of insufficient funds for future obligations.
- **Investment Choices:** Involves selecting assets whose values correlate with the liabilities.
- **Example:** Investing in bonds sensitive to interest rate changes if liabilities are similarly affected.
- **Outcome:** Correlation between asset and liability values helps mitigate funding gaps.

[2]

ii)

Underfunded Scheme: When the assets held do not fully cover the liabilities, it creates a funding gap, leading to potential solvency issues or the need for additional capital injections.

Term Mismatch: If the duration of the assets is shorter than that of the liabilities, there's a risk that the assets may not generate sufficient returns over time to meet long-term obligations.

Gaps in Bond Maturity: The absence of bonds with matching maturities can lead to reinvestment risk, where cash flows from assets may not align with the timing of liability payments.

Credit Risk in Government Bonds: A heavy reliance on government bonds can expose the portfolio to changes in the creditworthiness of the government, affecting the safety of the investments.

Change in Tax Status of Government Bonds: Any alterations in the tax treatment of government bonds can impact the net returns from these investments, affecting their suitability for hedging.

Mark to Market Risk: Discrepancies between the market valuation of assets and the accounting valuation of liabilities can lead to volatility in reported financial status, affecting stakeholders' perceptions and decision-making.

Mismatch Risk: If the correlation between assets and liabilities isn't perfect

Liquidity Risk: Some hedging assets, like long-term bonds, may lack liquidity, making it difficult to sell them without incurring losses, especially in volatile markets

Opportunity Cost: By focusing on matching liabilities, investors might miss out on higher returns from other investment opportunities.

Interest Rate Sensitivity: Hedging often involves interest-sensitive instruments like bonds. Fluctuations in interest rates can significantly impact the portfolio's value.

[3]

- iii) To determine which region would benefit most from the cross-currency swap, we need to calculate the Net Present Value (NPV) of future revenue streams for each region, both with and without the swap. The region with the greatest positive difference in NPV due to the swap would benefit the most.

Year (t)	Swap Cash flows (LCU)	Region A Revenue	Region B Revenue	Region C Revenue	Hedge Benefit (A) (SCF - RA)	Hedge Benefit (B) (SCF - RB)	Hedge Benefit (C) (SCF - RC)
1	20	18	10	9	2	10	11
2	20	5	22	20	15	-2	0
3	20	10	25	28	10	-5	-8

4	20	50	45	42	-30	-25	-22
5	200	180	175	170	20	25	30
				NPV	₹ 15.14	₹ 2.41	₹ 8.97

Calculations:

1. Calculate the Hedge benefit for each region

- The difference between the Swap Cash Flows and revenues of each region

2. Calculate the NPV for each region

$$\text{NPV: NPV}_A = \frac{2}{1.05} + \frac{15}{1.05^2} + \frac{10}{1.05^3} + \frac{-30}{1.05^4} + \frac{20}{1.05^5} = 15.14$$

$$\text{NPV}_B = \frac{10}{1.05} + \frac{-2}{1.05^2} + \frac{-5}{1.05^3} + \frac{-25}{1.05^4} + \frac{25}{1.05^5} = 2.41$$

$$\text{NPV}_C = \frac{11}{1.05} + \frac{0}{1.05^2} + \frac{-8}{1.05^3} + \frac{-22}{1.05^4} + \frac{30}{1.05^5} = 8.97$$

The region with the highest positive difference benefits the most. Hence, we can conclude that Region A benefit most from the cross-currency swap to achieve the corporation's hedging objectives.

[6]

[11 Marks]

Solution 11:

- i) This assumption is based on the concept of time value of money and the idea that the value of an asset is determined by the present value of its future cash flows. [1]
- ii) The model that incorporates the given data elements — market risk premium, SMB (Small Minus Big), and HML (High Minus Low) factors, along with the asset's specific sensitivities to these factors — is the **Fama-French Three-Factor Model**.

The expected return of the asset according to the Fama-French Three-Factor Model is calculated as follows:

$$\text{Expected Return} = R_f + \beta \times (R_m - R_f) + (\text{SMB} \times \text{Sensitivity to SMB}) + \text{HML} \times \text{Sensitivity to HML}$$

Where:

- R_f is the risk-free rate.
- β is the asset's beta.
- $R_m - R_f$ is the market risk premium.
- SMB is the Small minus Big factor.

- HML is the High minus Low factor.
- Sensitivity to SMB and HML are the asset's specific sensitivities to these factors.

Plugging in the given values:

Expected Return = $3\% + 1.1 \times 5\% + 1.3 \times 3\% + 0.8 \times 2\%$

Expected Return = $3\% + 5.5\% + 3.9\% + 1.6\%$

Expected Return = 14%

[2]

iii) The CAPM return is $3\% + 1.1 \times 5\% = 8.5\%$, lower than the FF return. If FF return is used as a discounting factor to value the asset, the PV of the future cash flows of the asset will be lesser and hence the value of the asset will be lower.

[3]

[6 Marks]

Solution 12:

i) Difference in Returns Between Actual and Benchmark Portfolio

Actual Portfolio Returns

1. Universal Bonds:

- GY1: 2750 to 2980 (8.36%)
- GY2: 2980 to 3200 (7.38%)
- GY3: 3200 to 3428.6 (7.14%)
- Weighted Return: 7.63% (55% allocation)

2. Cosmic Mineral Mining Ventures:

- GY1: 1250 to 1410 (12.8%)
- GY2: 1410 to 1580 (12.06%)
- GY3: 1580 to 1770.6 (12.07%)
- Weighted Return: 12.31% (25% allocation)

3. Planetary Real Estates:

- GY1: 1000 to 1060 (6%)
- GY2: 1060 to 1120 (5.66%)
- GY3: 1120 to 1166.4 (4.14%)
- Weighted Return: 5.27% (20% allocation)

Actual Returns (3 Years)

Initial Funds at the beginning: INR 5000 crore

Total Funds at the end of 3 years: $3,428.6 + 1,770.6 + 1,166.4 = \text{INR } 6365.6$ crore

Total Return = $(6365.6/5000) - 1 = 27.31\%$

Benchmark return during the period (60% UB and 40% PRE)

Initial Investment: Universal Bonds = 3000 and Planetary Real Estates = 2000

Total Funds at the end of the 3 years going with the benchmark returns in each period = $3000 \times (1.06) \times (1.065) \times (1.07) + 2000 \times (1.045) \times (1.04) \times (1.042) = \text{INR } 5888.66 \text{ crore}$

Total Return = $(5888.66/5000) - 1 = 17.77\%$

Difference in returns = $27.31\% - 17.77\% = 9.54\%$

(OR)

Benchmark Portfolio return during the period (60% UB and 40% PRE)

Initial Investment: Universal Bonds = 3000 and Planetary Real Estates = 2000

Total Funds at the end of the 3 years going with the benchmark returns in each period = $(3000 \times 1.0836 \times 1.0738 \times 1.0714 + 2000 \times 1.06 \times 1.0566 \times 1.0414) = \text{INR } 6072.67 \text{ crore}$

Total Return = $(6072.67/5000) - 1 = 21.45\%$

Difference in returns = $27.31\% - 17.77\% = 9.54\%$

[4]

ii) Excess Return from Cosmic Mineral Mining Ventures

Excess Return = Return from Mining Ventures - Return from Planetary Real Estates

Excess Return = $12.31\% - 5.27\% = 7.04\%$

[2]

iii) Comment on the CIO's Decision

- **Positive Aspects:**

- The decision to invest in cosmic mineral mining ventures has yielded a significantly higher return (12.31%) compared to planetary real estates (5.27%).
- The overall portfolio performance (27.31%) greatly exceeded the benchmark return (17.77%) or even Benchmark portfolio return (21.45%) indicating a successful reallocation strategy.

- **Considerations:**

- The high returns from cosmic mineral mining ventures might reflect a higher risk profile, which should be considered in the context of the fund's risk tolerance.
- The sustainability of these high returns should be evaluated, as over-reliance on a single high-performing sector can lead to increased vulnerability to sector-specific risks.

- **Additional considerations**

- **Diversification:** The CIO's decision to diversify into cosmic mineral mining ventures introduces a new asset class, potentially reducing overall portfolio risk through diversification.
- **Market Insight:** The decision suggests a keen market insight and ability to capitalize on emerging opportunities, which is crucial for long-term fund growth.

- **Future Outlook:** The CIO's decision may be based on a long-term positive outlook for the cosmic mineral sector, aligning with future growth expectations.
- **Risk Management:** While the decision has paid off in the short term, it's important to continuously assess the risk-return profile to ensure alignment with the fund's objectives.

[4]

[10 Marks]
