📄 Portfolio Optimization Report

1. Objective

The objective of this assignment was to construct a portfolio using real historical monthly data of three Indian stocks:

- Reliance Industries (RELIANCE.NS)
- Infosys (INFY.NS)
- ICICI Bank (ICICIBANK.NS)

The time period considered was from **January 2020 to May 2023**. The aim was to evaluate portfolio performance using:

- Expected Returns
- Standard Deviation (Volatility)
- Covariance Matrix
- Sharpe Ratio

We also visualized the **Efficient Frontier** to identify optimal portfolios such as the **Minimum Variance Portfolio** and the **Tangency Portfolio**.

2. Key Observations

a) Effect of Diversification

Diversification helped reduce the overall risk of the portfolio:

- Combining stocks from different sectors (energy, IT, and banking) led to **low correlation** between their returns.
- Even though individual stock volatility was high, the **portfolio volatility was lower** in diversified combinations.

Conclusion: Diversification provides more stable returns and reduces unsystematic risk.

b) Effect of Changing Weights

Changing the weights of the assets in the portfolio:

- Affected both return and risk.
- Portfolios tilted toward high-return stocks had higher expected returns, but also higher risk.
- Portfolios with **balanced weights** (like 40% INFY, 40% RELIANCE, 20% ICICI) had a **better Sharpe Ratio**.

Conclusion: Careful adjustment of weights can improve the portfolio's risk-return profile.

c) Recommended Portfolio

The **Tangency Portfolio** (i.e., the one with the highest Sharpe Ratio) is recommended:

- **Annualized Return**: ~13.4%
- **Risk**: Moderate
- **Sharpe Ratio**: Highest among all portfolios

Conclusion: This portfolio offers the **best risk-adjusted return** and lies on the **Capital Market Line**.

3. Visualizations and Metrics

The following visuals were used:

- **Efficient Frontier:** Showing risk-return combinations of thousands of portfolios.
- **Capital Market Line (CML):** Line from the risk-free rate to the Tangency Portfolio.
- **Minimum Variance Portfolio:** Identified as the left-most point on the Efficient Frontier.