DA6701 Assignment 1

Group 7 (EE23B117, CS23B016, EE23B180, CH22B007, CS23B096)

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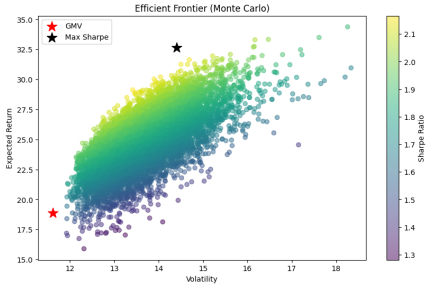
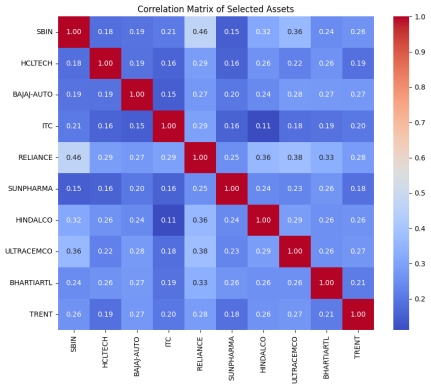
Logic behind Stock Selection

We first selected one stock from each sector having the least average correlation with other stocks in that sector.

Reason: Lower correlation captures independent information and improves diversification. [1]
Remaining stocks (if fewer than 10 were selected) were added by minimizing average pairwise portfolio correlation.



(a) Efficient Frontier



(b) Correlation Matrix

	Stock	GMV Weight	Max Sharpe Weight
0	SBIN	8.402691e-02	1.581700e-01
1	HCLTECH	1.114988e-01	4.250083e-02
2	BAJAJ-AUTO	6.965165e-02	2.092403e-01
3	ITC	2.545351e-01	1.316900e-16
4	RELIANCE	2.554318e-02	1.248355e-16
5	SUNPHARMA	2.287081e-01	9.125012e-02
6	HINDALCO	4.743425e-03	2.280204e-02
7	ULTRACEMCO	1.036798e-01	2.920429e-02
8	BHARTIARTL	1.176130e-01	3.451900e-01
9	TRENT	2.233008e-16	1.016425e-01

(c) Weight Attribution

Return and Risk Estimation

Annualized metrics were computed as $\mu = 252\,\mu_{daily}$,
$\Sigma = 252\,\Sigma_{daily}$. Risk-free rate used: $R_f = 6.5\%$.

Portfolio Metrics

Portfolio return: $R_p = w^T\mu$ Risk: $\sigma_p = \sqrt{w^T\Sigma w}$ Sharpe Ratio:

$$\text{Sharpe}(w) = \frac{R_p - R_f}{\sigma_p}$$

Constraints: $\sum_i w_i = 1,\ 0 \le w_i \le 1$

Optimization

GMV Portfolio: $w^{GMV} = \arg\min_w \sqrt{w^T\Sigma w}$
Maximum Sharpe Portfolio:

$$w^{MS} = \arg\max_w \frac{w^T\mu - R_f}{\sqrt{w^T\Sigma w}}$$

Both solved using SLSQP under long-only constraints.

Efficient Frontier

10,000 random portfolios were simulated using $w_i \sim U(0,1)$, $w_i = \frac{w_i}{\sum_j w_j}$. GMV and Maximum Sharpe portfolios were highlighted.

Conclusion

- Correlation filtering improved diversification.
- Optimization produced risk-efficient portfolios.
- Results align with Modern Portfolio Theory.

Compiled results are given below:

Metric	Max Sharpe Portfolio	GMV Portfolio
Expected Annual Return	3263.08%	1888.86%
Annual Volatility	1440.16%	1162.15%
Final Sharpe Ratio	2.261	1.620

[1] H. Markowitz, "Portfolio Selection," *The Journal of Finance*, vol. 7, no. 1, pp. 77–91, Mar. 1952.