**Project Outline: Integrated Quantitative Portfolio Investment Strategy**

**1. Project Objectives**

* **Primary Goal:** Develop a quantitative investment framework that outperforms the composite index by combining fundamental analysis with quantitative methods (CAPM, Fama-French 5-factor, monte carlo and efficient frontier models) with technical trading signals (optional).
* **Key Deliverables:**
  + Estimate expected returns using Efficient Frontier, CAPM, Fama French regression analysis.
  + Build an efficient frontier via Monte Carlo simulation.
  + Integrate technical indicator strategies for timing and selection.
  + Backtest and compare the performance against a benchmark (NQ-100 & SPY).

**2. Data Collection & Preprocessing**

* **Data Acquisition:**
  + Download historical price and volume data for the Nasdaq-100 constituents (2016–2024) using Yahoo Finance.
  + Obtain benchmark data (SPY), risk-free rates, and Fama-French factor returns.
* **Data Cleaning & Preparation:**
  + Align data frequencies (e.g., daily or monthly returns).
  + Compute derived variables: returns, moving averages, volatility metrics, etc.
  + Create a master DataFrame consolidating all necessary data points.

**3. Fundamental Analysis via Regression**

* **CAPM Regression Analysis:**
  + For each stock, regress historical returns against market returns to calculate beta using the CAPM formula.
  + Outcome: A set of expected returns based on market risk.
* **Optional: Fama-French 5-Factor Model:**
  + Extend the regression framework by including size, value, profitability, and investment factors.
  + Run regressions for each stock to determine factor loadings.
  + Adjust expected returns using the estimated factor premiums.
  + Outcome: Refined expected returns that incorporate multiple dimensions of risk.

**4. Monte Carlo Simulation for Portfolio Optimization**

* **Portfolio Generation:**
  + Compute the covariance matrix of stock returns.
  + Generate a large number of random portfolios (10,000 simulations) using random weight assignments.
* **Efficient Frontier Construction:**
  + Calculate portfolio return, volatility, and Sharpe ratio for each simulation.
  + Identify key portfolios such as the minimum variance portfolio and the one with the maximum Sharpe ratio.
* **Integration with Fundamentals:**
  + Use the expected returns derived from CAPM and Fama-French models as inputs for the Monte Carlo simulation.
  + Outcome: An optimized portfolio set that lies on the efficient frontier, balancing risk and return and maximizing sharpe ratio.

**5. Optional: Incorporating Technical Indicator Strategies**

* **Technical Indicator Calculation:**
  + Compute key indicators: Simple Moving Averages, ATR, RSI, MACD, Bollinger Bands, Volume etc.
  + Define clear buy and sell signals (e.g., golden cross for SMA, oversold/overbought thresholds for RSI).
* **Signal Integration:**
  + Develop rule-based logic to generate trading signals from technical indicators.
  + Combine these signals with the fundamental-based portfolio weights to adjust asset allocation dynamically.
  + Outcome: A hybrid strategy that leverages both long-term fundamentals and short-term market timing.

**6. Backtesting & Performance Evaluation**

* **Backtesting Framework:**
  + Simulate the integrated strategy (combining optimized portfolio weights and technical signals) over the historical period.
  + Compare the performance against a benchmark (e.g., SPY buy-and-hold strategy).
* **Performance Metrics:**
  + Evaluate returns, Sharpe ratio, alpha, and drawdowns.
  + Conduct sensitivity analysis on key parameters (e.g., factor premiums, beta estimates, technical signal thresholds).
  + Outcome: Detailed performance report highlighting the strategy’s strengths and potential risks.

**Integrated Strategy & Portfolio Construction**

* **Merging Models:**
  + Combine the outputs from the fundamental models with our technical signals.
  + Use the optimized weights from the efficient frontier as a starting point and adjust them based on technical trading signals.
* **Sector & Risk Weighting:**
  + Analyze sector performance to identify which sectors (e.g., Communication Services, Healthcare) add value.
  + Apply risk management techniques (via Monte Carlo simulations) to compute optimal asset weights and adjust the portfolio’s risk profile.

**7. Reporting & Next Steps**

* **Documentation:**
  + Compile detailed documentation of methods, assumptions, and results.
  + Prepare a comprehensive report with visualizations (efficient frontier plots, backtest results, performance metrics).
  + Highlight the outperformance of our strategy—for instance, our backtest shows that our final weighted portfolio outperformed SPY by over 2235%.
* **Iteration & Live Testing:**
  + Based on backtest outcomes, refine model parameters and strategies.
  + Plan a phased rollout, starting with paper trading to validate the approach in real time.
  + Allocate tasks for model refinement, further data analysis, and eventual deployment.