Portfolio:

- Stock A, 60%
- Stock B, 30%
- Stock C, 10%

Analysis that we are running on the portfolio:

In finance, a number "+10% return" is meaningless in a vacuum. It only has meaning when compared to an alternative. We evaluate a portfolio (a set of stocks) by asking three fundamental questions:

1. The Survival Test (Inflation): Did the portfolio make money *in real terms*?
    - i.e. if your portfolio grew by 2% but inflation was 3%, you actually *lost* purchasing power.
    - CPI (Consumer Price Index) or a **flat inflation rate (e.g., 3%)**.
    - We test whether portfolio return is greater than inflation or not.
2. The Opportunity Cost Test (S&P 500): Could the portfolio have made this money *doing nothing*?
    - User could have just bought the entire S&P 500 (the 500 biggest US companies) with one click. If you spent hours picking specific stocks (Stock A, Stock B) but made *less* money than the S&P 500, you wasted your time.
    - Portfolio's return must be higher than the S&P 500 return.
3. The "Skill" Test (Risk-Adjusted Return): Did portfolio take on too much danger to get this return?
    - Making 20% is great. But if you took a risk that could have wiped you out to get it, that was "bad" investing (gambling). We need to measure if the speed was worth the bumpiness.
    - Beta scoring. Beta>1 => more volatile than S&P 500.
    - We test whether beta <=1.

Fetching:

- Market data
    - Getting price **returns** from raw data of closing prices
    - (today's closure price / yesterday's closure price) - 1

need to find:

- Portfolio Return (Rp): The weighted average return of the user's stocks over the period.
    - PR1: avg return for Stock A over 1 year
    - PR2: avg return for Stock B over 1 year
    - PR3: avg return for Stock C over 1 year
    - Percentage split: p1, p2, p3 (e.g. 0.6, 0.3, 0.1)
    - Rp = PR1*p1 + PR2*p2 + PR3*p3.
- Market Return (Rm): The return of the S&P 500 over the same period.
    - Rm: avg return of S&P 500 over 1 year
- Risk-Free Rate (Rf): Usually the 10-Year Treasury Yield (currently ~4-4.5%). This is the return you get for taking zero risk.
    - Rf: fixed rate, 4%, i.e. 0.04
- Beta (β): A measure of how volatile the portfolio is compared to the market.
    - Volatility of S&P 500 is defined as 1.0.
    - Annual (individual!) volatility = daily std * sqrt(252)
        - Daily std:
            - Collect closing prices
            - (today's closure price / yesterday's closure price) - 1

        - STD of the above data
    - to find the covariance between Stock A and Stock B, you multiply their deviations together for every single day, sum them up, and divide by the number of days.
    - STD of portfolio = sqrt( weights^T * CovMatrix * weights)

Score calculation:

1. Survival Test, Inflation (**30** points)
    - Survival gradient: if Inflation is 3% and you made 2.9%, you preserved almost all your wealth. That is infinitely better than losing -20%. So we set a "Floor" (0% return) and a "Ceiling" (a great return, e.g., 10% or Inflation + 7%).
    - Floor (<0% Return): 0 Points. (You lost nominal money. This is bad.)
    - Baseline (0% to Inflation): 1 to 15 Points. (You made money, but lost purchasing power. Better than nothing.)
    - Target (> Inflation): 16 to 30 Points. (You grew your wealth in real terms.)
    - ScoreInflation = ( Rp / 0.1 ) * 30pts
2. Opportunity Cost Test, S&P 500 (**40** points)
    - α=0: You did exactly as well as the market expected for your risk level. This is actually a good result.
    - α>0: You are beating the market (great).
    - α<0: You are underperforming (bad).
    - Since beating the market is extremely hard, we shouldn't punish a user too hard for having an Alpha near 0.
        - We will center the score at 20 points (half credit) for an Alpha of 0.
        - Range: We will look at an Alpha range of -5% to +5%.
        - Alpha <= -5%: 0 Points (failed badly).
        - Alpha = 0%: 20 Points (solid, efficient investment).
        - Alpha >= +5%: 40 Points (amazing).
    - ScoreAlpha = 20 + (alpha * 400);  ← /clamp it to be 0..40/
3. "Skill" Test, Risk-Adjusted Return (**30** points)
    - Sharpe <0: 0 Points.
    - Sharpe =1.0 (Market Average): 15 Points.
    - Sharpe >=2.0: 30 Points.
    - Sharpe ratio measures "Return per unit of Risk."
        - **Sharpe = ( Rp - Rf ) / StdPortfolio**
    - ScoreSharpe = Sharpe * 15;  ← /clamp it to be 0..30/

The score should be >65 to be Good.

Example: