Problem 1: Suppose you received a gift of $1000 on January 1, 2021 (what an excellent New Year's gift!). You decided to invest 50% of this money to Intel Share (INTC; as yahoo finance call it) and 50% to SSAB-A share (SSAB-A.ST; as yahoo finance call it). For simplicity, assume that you can invest any amount to any share (i.e. you are allowed to buy a fraction of a share) and you invest the whole amount on the first trading day of 2021. However, as a rational investor, you also prepare a qualified forecast of your fortune by the end of June 2025 (4 and half years ahead).

Tasks:

1. Extract historical data on the stocks of your interest INTC, and SSAB-A.ST)
2. Derive mean daily log-return of the share prices based on their daily closing price. Note that if S_t is the closing share price at day "t" then log-return is defined as $R_t = log\left(\frac{X_t}{X_{t-1}}\right)$.
3. Assume that daily log-return follows a normal distribution with some constant mean "μ" and constant variance "σ^2", i.e. $R_t \sim N(\mu, \sigma)$. Estimate of the unknown parameters using historical data. Simulate, for the next 4 and half years, the trajectories of the share prices starting from the first trading day of 2021 using the normal model. For simplicity, you may assume that a trading year consists of 252 trading days.
4. Based on a large number of simulated trajectories (as in task 3), do you find your investment profitable? How much profit/loss do you expect? Compare your simulation results with the actual result (as per the real stock process on the last trading day of June, 2025).

Problem 2: Repeat tasks 3-4, in Problem 1 but this time don't assume that the variance of the log-return series is constant. Instead, apply JP Morgan's risk metrics for volatility which suggest the variance to be calculated as follows:

$$\sigma_t^2 = 0.94\sigma_{t-1}^2 + 0.06R_{t-1}^2$$

where σ_t^2 is the variance of log-return at day "t". You may take initial estimate of σ_t^2 from Problem 1. Also keep the estimate of μ from problem 1. Also give a VaR at confidence level 90% of your investment (for the same time window, as in problem 1).