Question B.2

Here we document the derivation of the return of a portfolio allocation $R_{p,t}$ We have that $R_{p,t}$ is given by:

$$R_{p,t} = \alpha_t R_t + (1 - \alpha_t) R_{f,t}$$

However, in our data-set we have the column $\beta_t = k\alpha_t$ for a given k. This means, we have

$$R_{p,t} = \frac{\beta_t}{k} R_t + \left(1 - \frac{\beta_t}{k}\right) R_{f,t}$$

Which can be simplified to:

$$R_{p,t} = \frac{\beta_t (R_t - R_{f,t})}{k} + R_{f,t}$$

Now with this formula, we can augment our dataframe and calculate the necessary mean and variance, for a given k