

1. In this problem, you will construct portfolios with weekly returns of 6 stocks. The companies are Amazon, 3M, Boeing, Visa, UnitedHealth, Micron Technology. The ticker symbols is given in the following R code.

```
> syb = c("AMZN", "MMM", "BA", "V", "UNH", "MU")
```

Please refer to the R code in Question 1 of Homework 4 to download the stock quotes of these 6 companies, setting `from = "2009-01-01"`, `to = "2021-03-01"` in using `getSymbols()`. Also create a matrix whose columns are weekly returns of these companies and assign column names for clarity. Name the matrix `y` if you plan to use my code in Handout 6. The returns should be in percentages,

```
> y = 100*y
```

Please refer to the textbook and its webpage for the R code of plotting portfolios. You will find the code for the solution of R-Lab §16.10 Problem 1 helpful.

Consider portfolios that allow short selling.

- (a) Find the minimum variance portfolio: its expect return, its risk and allocation weights.
 - (b) The annual risk-free rate is 3%, convert it to weekly (52 weeks a year). Find the tangency portfolio: its expect return, its risk and allocation weights.
 - (c) Plot the efficient frontier, the tangency portfolio, the minimum variance portfolio, location of each stock in the plot. Find and plot the efficient portfolios (combing with risk free asset), this is the line connect risky free portfolio $(0, \mu.f)$ and tangency portfolio $(sd.T, \mu.T)$,


```
> lines(c(0,sd.T), c(mu.f, mu.T))
```
 - (d) Find the efficient portfolio of an allowed risk 2%. Compute its return.
 - (e) Find the efficient portfolio of a target return 0.45%. Compute its risk.
 - (f) Find the efficient portfolio of a target return 0.8%. Compute its risk.
2. Use the same data of Question 1 to repeat Parts (a) – (e) for the case that short selling is not allowed.
3. Consider again the data in 1, what is the set of feasible expected portfolio returns with the constraints $-0.1 \leq w \leq 0.4$ for all $i = 1, \dots, 6$. (Do not compute any portfolio, just find the feasible set of μ_R).
4. §16.11 Exercises, Problems 1, 2 and 6.