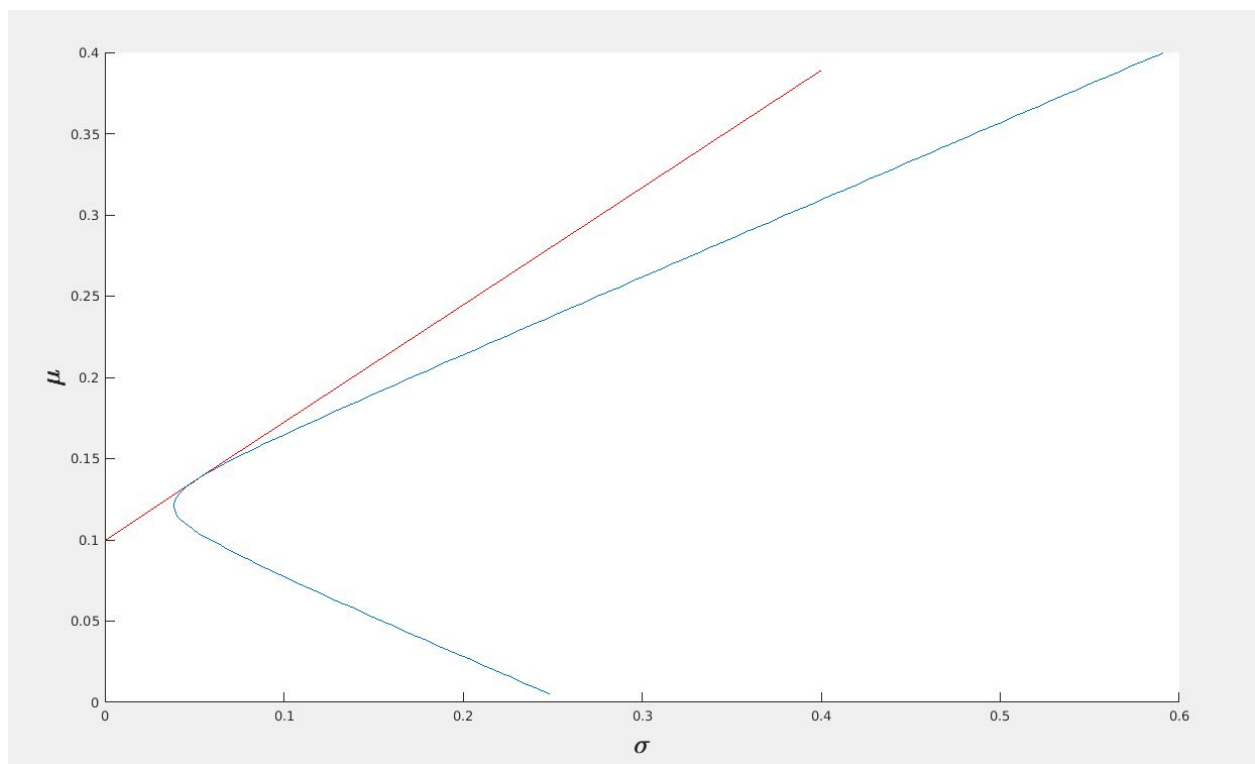## Problem 1:

$$M = \begin{bmatrix} 0.1 & 0.2 & 0.15 \end{bmatrix}$$

$$C = \begin{bmatrix} 0.005 & -0.010 & 0.004 \\ -0.010 & 0.040 & -0.002 \\ 0.004 & -0.002 & 0.023 \end{bmatrix} .$$

For the above mean and covariance values the following is the Markowitz efficient frontier diagram.

```
mu        sigma     w(1)      w(2)      w(3)
0.10      0.0587    1.1193    0.1193    -0.2385
0.12      0.0385    0.8330    0.2330    -0.0661
0.14      0.0556    0.5468    0.3468    0.1064
0.16      0.0910    0.2606    0.4606    0.2789
0.18      0.1306    -0.0257   0.5743    0.4514
0.20      0.1714    -0.3119   0.6881    0.6239
0.22      0.2129    -0.5982   0.8018    0.7963
0.24      0.2546    -0.8844   0.9156    0.9688
0.26      0.2965    -1.1706   1.0294    1.1413
0.28      0.3385    -1.4569   1.1431    1.3138
```

```
for 0.15 risk minimum and maximun return portfolios are as follows
mu         w(1)      w(2)      w(3)
0.05       1.7971    -0.1501   -0.6470
0.19       -0.1631   0.6289    0.5341
```
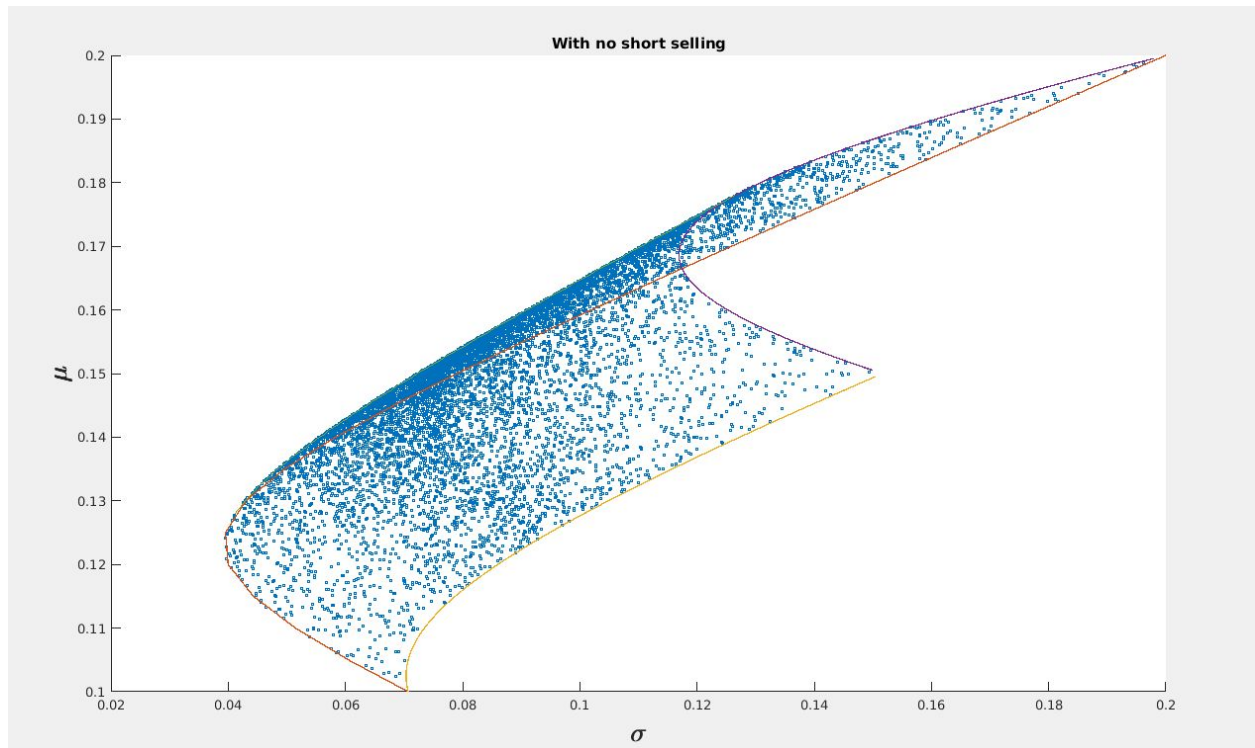
```
mu        sigma     w(1)      w(2)      w(3)
0.18      0.1306    -0.0257   0.5743    0.4514
```
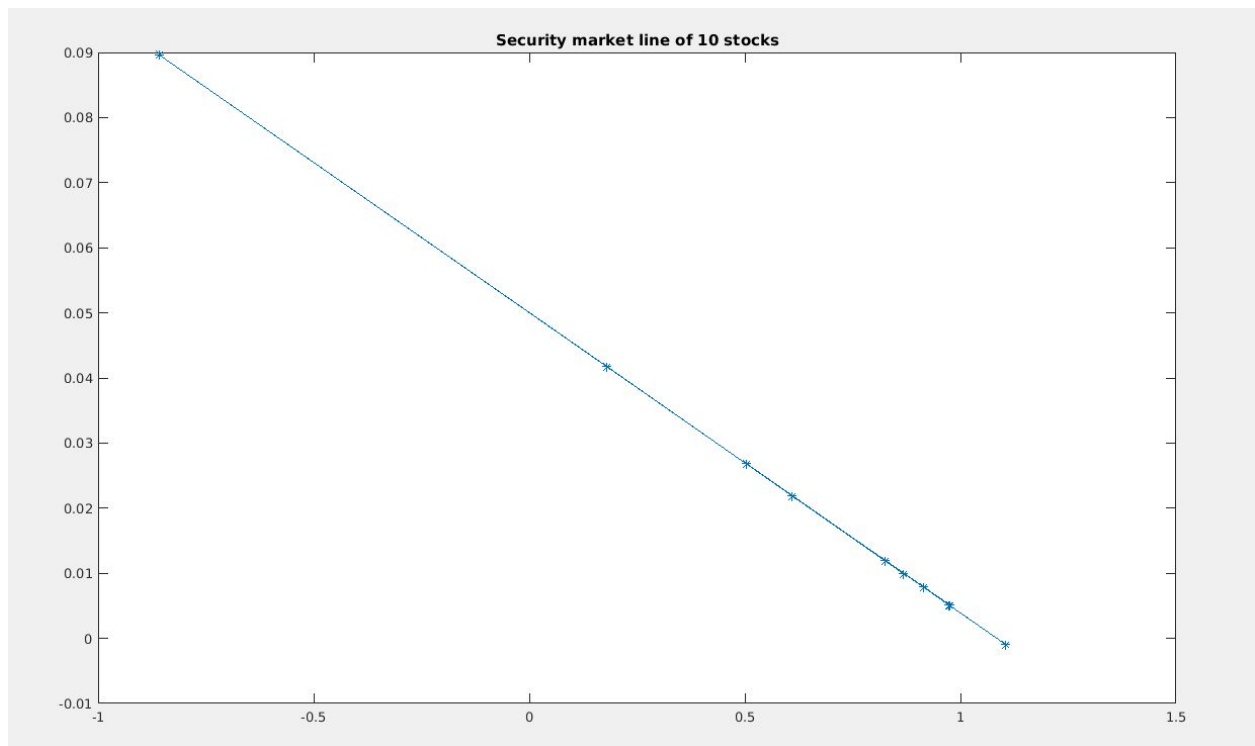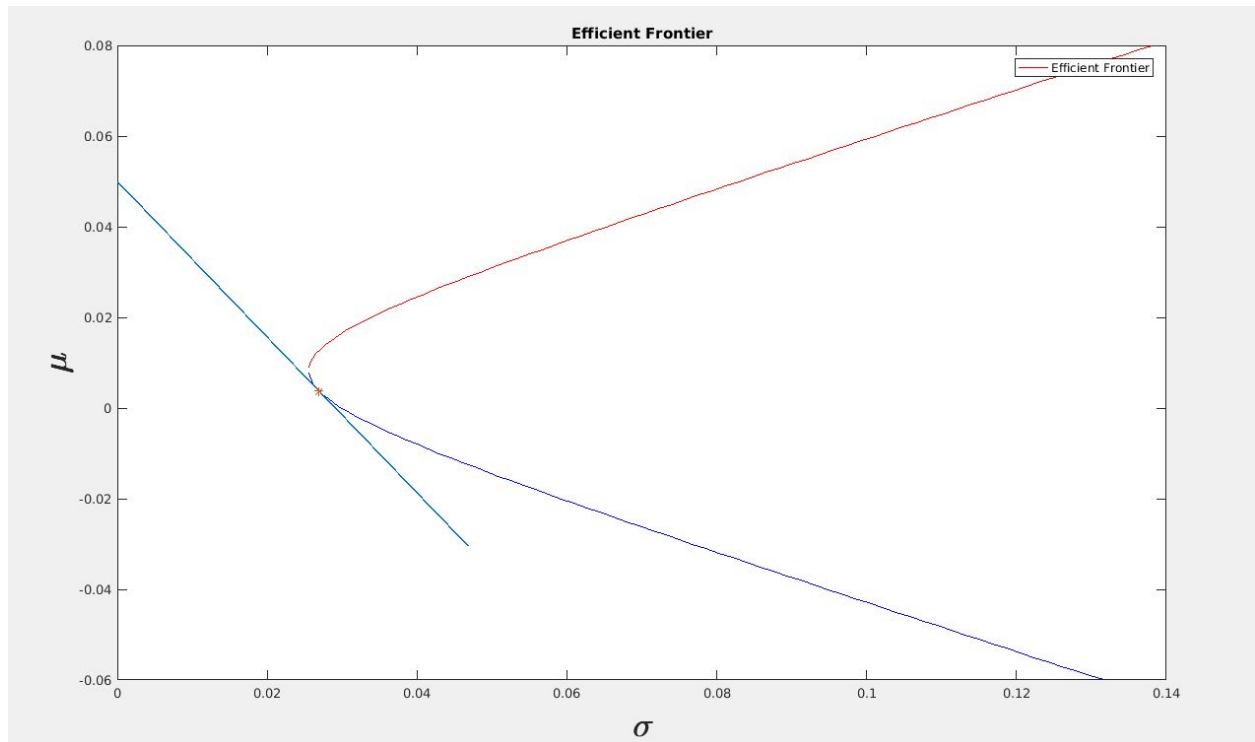
```
portfolios with 0.1 and 0.25 risk with risk free asset are as follows
mu        sigma     w(1)      w(2)      w(3)      w(4)-risk free
0.03      0.10      -1.151    -0.6361   -0.1515   2.9385
0.17      0.10      1.16      0.6410    0.1526    -0.9536
0.28      0.25      2.925     1.6166    0.3849    -3.9268
```

Problem 2:

With no short selling

Problem 3:

Efficient Frontier

Security market line of 10 stocks

The market portfolio values are myu=0.003881 sigma=0.026849