MA 374 - Financial Engineering Lab - 4

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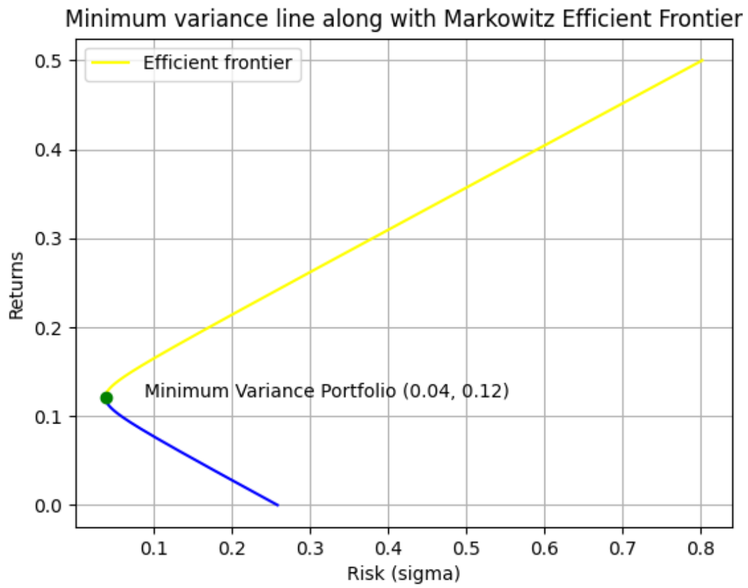
Question 1:




```
==================  sub-part (a) ==================



==================  sub-part (b) ==================

Index   weights                                    risk                    return

1.      [ 1.83550649 -0.1653936  -0.67011288]     0.04995499549954996     0.024056120176134635
2.      [ 1.11983859  0.11903851 -0.2388771 ]     0.09995999599959997     0.0034570647912316394
3.      [0.40417069 0.40347062 0.19235869]        0.14996499649964998     0.005229455948986979
4.      [-0.3114972   0.68790274  0.62359447]     0.19996999699969997     0.029373293649400726
5.      [-1.0271651   0.97233485  1.05483025]     0.24997499749975        0.07588857789247277
6.      [-1.742833    1.25676696  1.48606604]     0.29997999799979996     0.144775308678203
7.      [-2.4585009   1.54119907  1.91730182]     0.34998499849985        0.2360334860065915
8.      [-3.17416879  1.82563119  2.34853761]     0.3999899989999 0.349663109877639
9.      [-3.88983669  2.1100633   2.77977339]     0.44999499949995003     0.4856641802913446
10.     [-4.60550459  2.39449541  3.21100917]     0.5     0.6440366972477071
```

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==================  sub-part (c) ==================

Minimum return  = 0.052455245524552455
weights         = [ 1.79972309 -0.151172   -0.64855109]

Maximum return  = 0.1895689568956896
weights         = [-0.16263828  0.62874086  0.53389743]


==================  sub-part (d) ==================

Minimum risk for 18% return     =  13.056827100982627  %
Weights                         =  [-0.02568807  0.57431193  0.45137615]
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```
==================  sub-part (e) ==================

Market Portfolio Weights        =  [0.59375  0.328125 0.078125]
Return                          =  0.13671875
Risk                            =  5.081128919221594  %

Equation of CML is:
y = 0.72 x + 0.10
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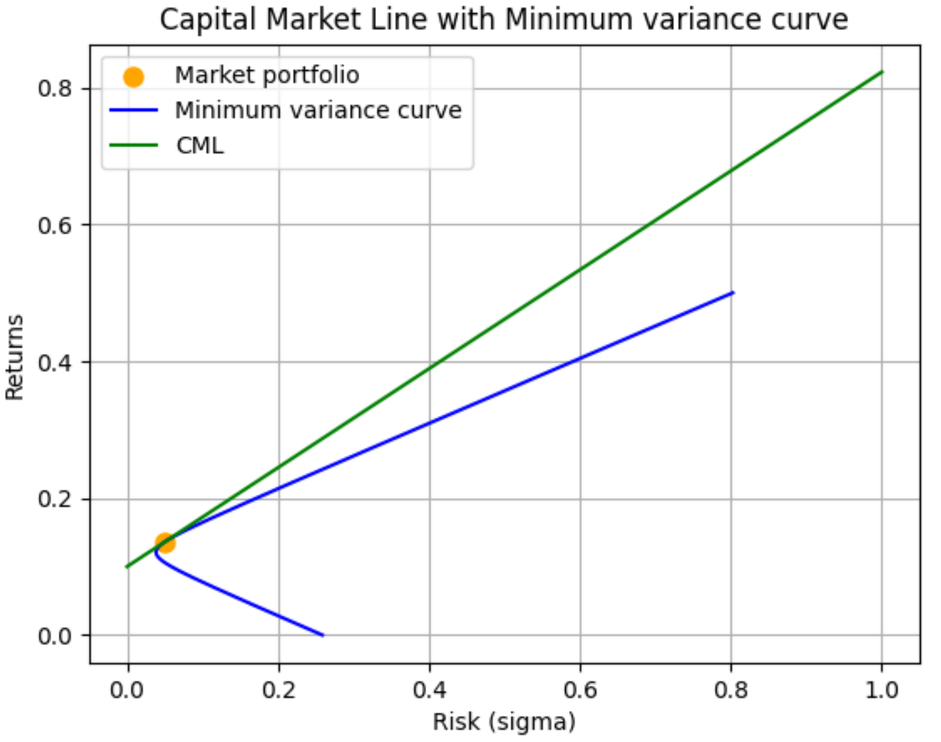

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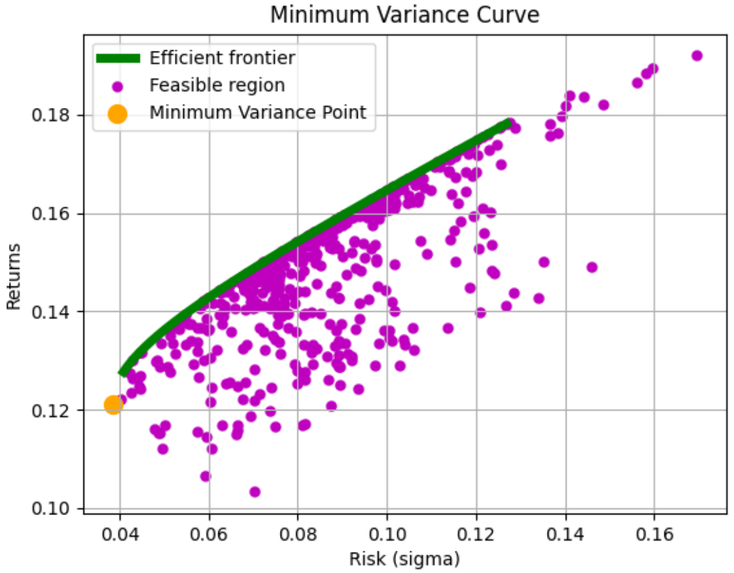
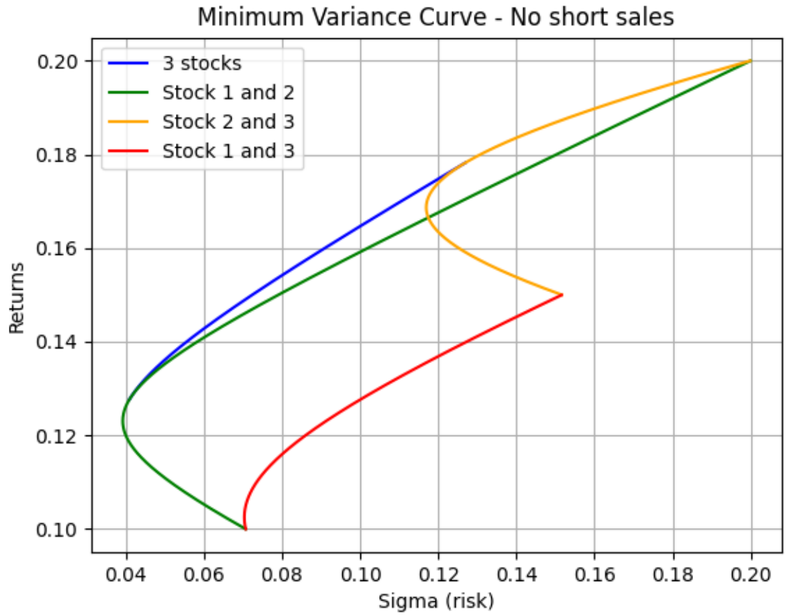
==================  sub-part (f) ==================

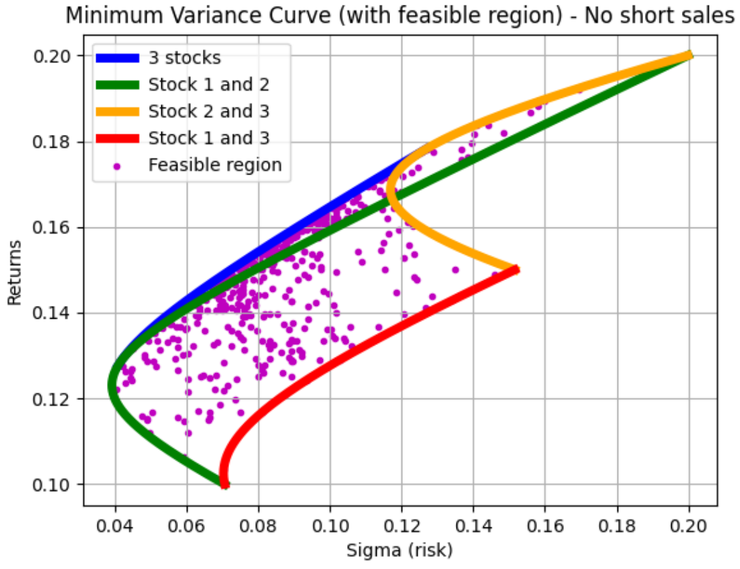
Risk                        = 10.0  %
Risk-free weights           = -0.9680665771282883
Risky Weights               = [1.16853953 0.64577185 0.1537552 ]
Returns                     = 0.17226494462892933


Risk                        = 25.0  %
Risk-free weights           = -3.920166442820721
Risky Weights               = [2.92134883 1.61442961 0.384388  ]
Returns                     = 0.2806623615723233
srishti@LAPTOP-ODVKPE0B:/mnt/c/Users/ksris/Documents/Sem_6/MA374_FinanceLab
```

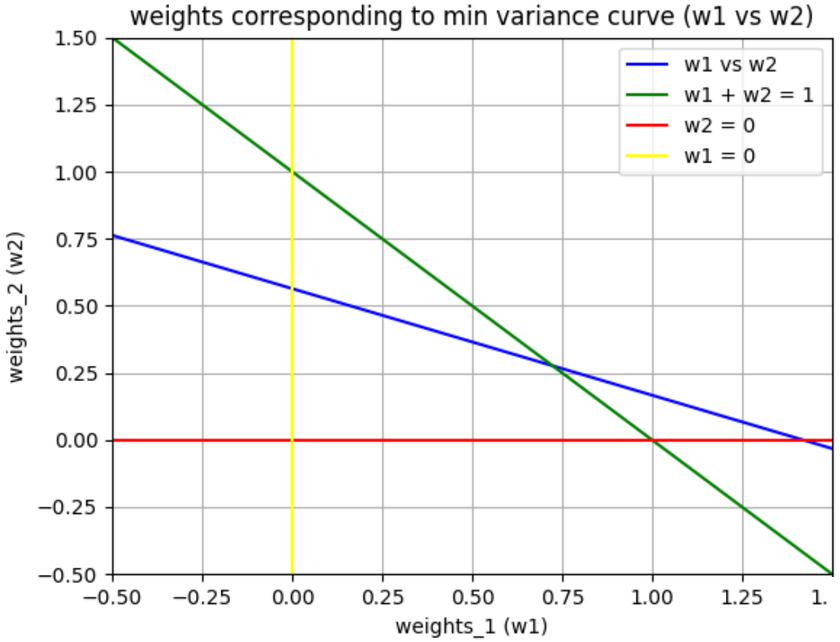
Question 2:


Minimum Variance Curve
Efficient frontier
Feasible region
Minimum Variance Point
Returns
Risk (sigma)
0.10
0.12
0.14
0.16
0.18
0.04
0.06
0.08
0.10
0.12
0.14
0.16


Minimum Variance Curve - No short sales
3 stocks
Stock 1 and 2
Stock 2 and 3
Stock 1 and 3
Returns
Sigma (risk)
0.10
0.12
0.14
0.16
0.18
0.20
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20


Minimum Variance Curve (with feasible region) - No short sales
3 stocks
Stock 1 and 2
Stock 2 and 3
Stock 1 and 3
Feasible region
Returns
Sigma (risk)
0.10
0.12
0.14
0.16
0.18
0.20
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20

```
Eqn of line w1 vs w2 is:
w2 = -0.40 w1 + 0.56
```

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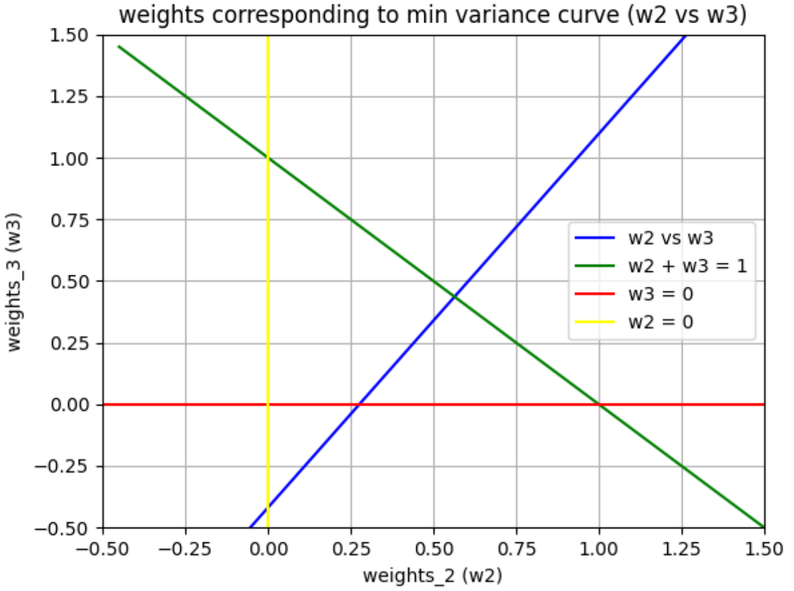
Eqn of line w2 vs w3 is:
w3 = 1.52 w2 + -0.42
```

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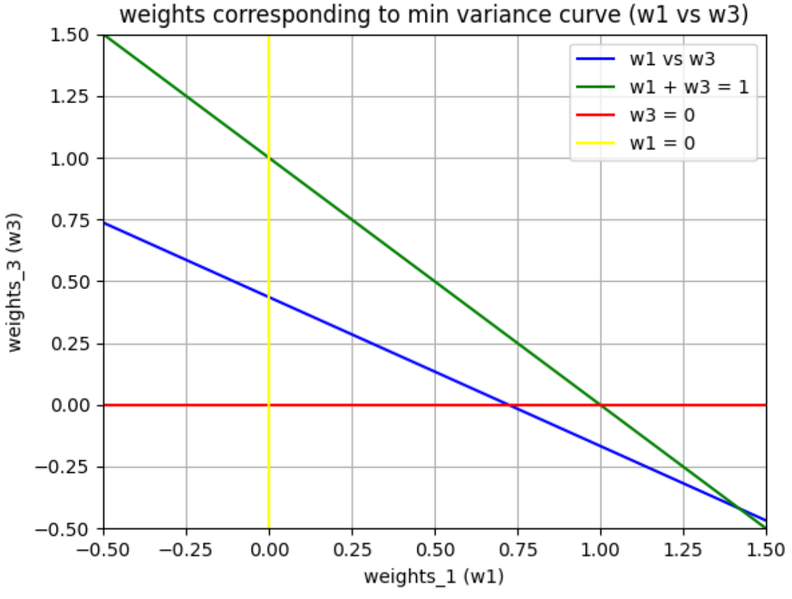
Eqn of line w1 vs w3 is:
w3 = -0.60 w1 + 0.44
```

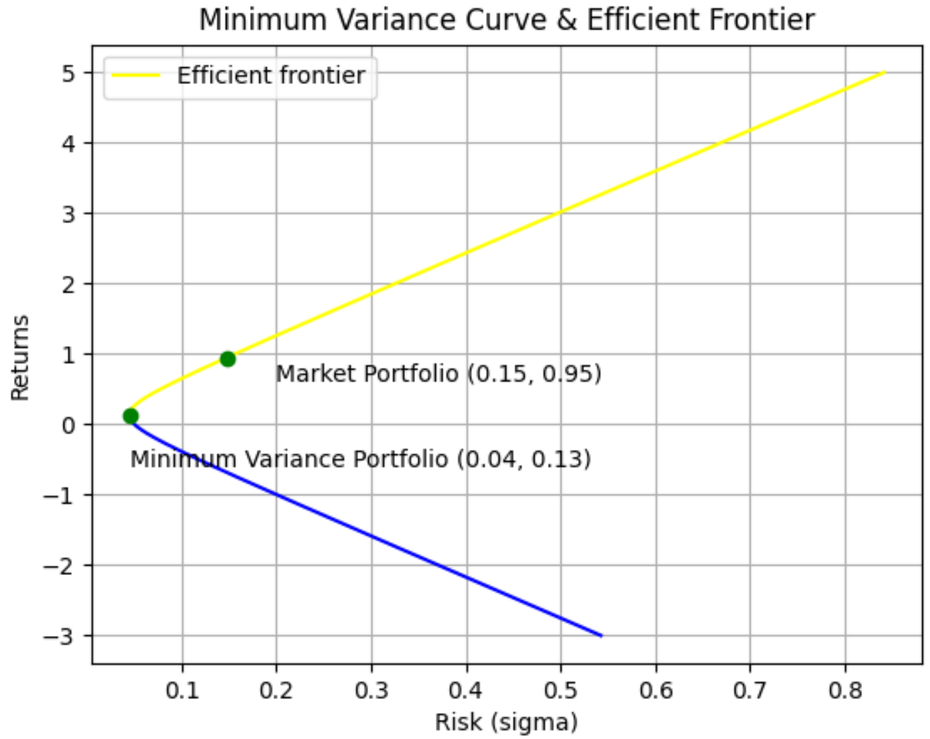


Question 3:

The data for the stocks had been collected for the time period between 01/01/2015 to 01/12/2019 on monthly basis (total 60 data points).

The companies considered are **Apple, Amazon, Facebook, Google, IBM, Intel, Microsoft, Netflix, Nike, and Tesla**. The monthly return was obtained as the difference in stock prices between beginning of 2 consecutive months. Then annual return was calculated suitably.

a) The Markowitz efficient frontier is:

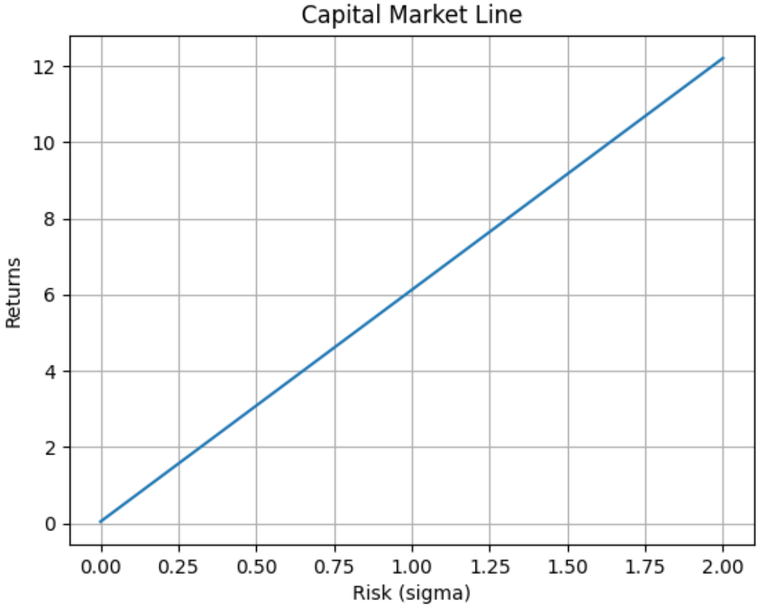


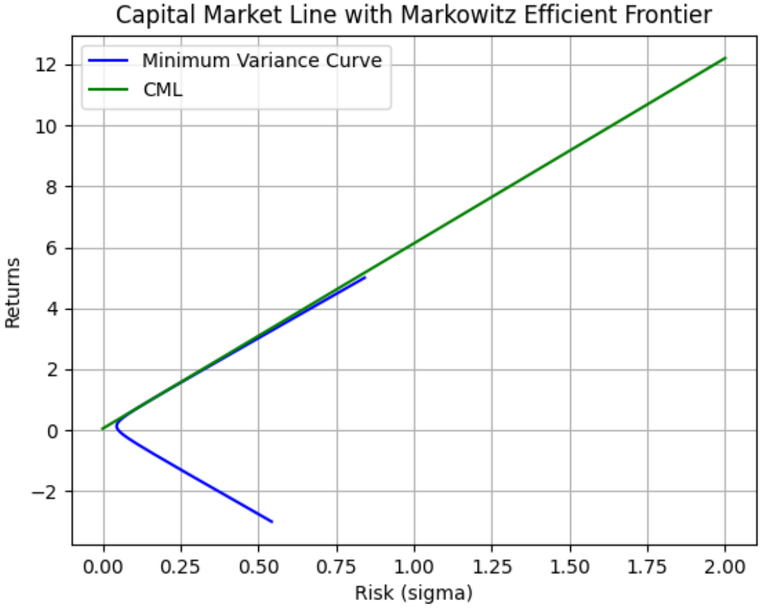
```
==================  sub-part (b) ==================

Market Portfolio Weights        =  [ 0.22761242  1.13992789 -0.21802614 -0.27195818 -1.86085521 -0.2067485
  1.09153062  0.28576137  0.7953939   0.01736182]
Return                          =  0.9494417828642234
Risk                            =  14.801199750536012  %
```

```
==================  sub-part (c) ==================


Equation of CML is:
y = 6.08 x + 0.05
```





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==================  sub-part (d) ==================

Eqn of Security Market Line is:
mu = 0.90 beta + 0.05
```