Ma374-LAB 04

Name: Harsh Yadav **Roll. No.**: 180123015 **Dept.**: Mathematics and Computing

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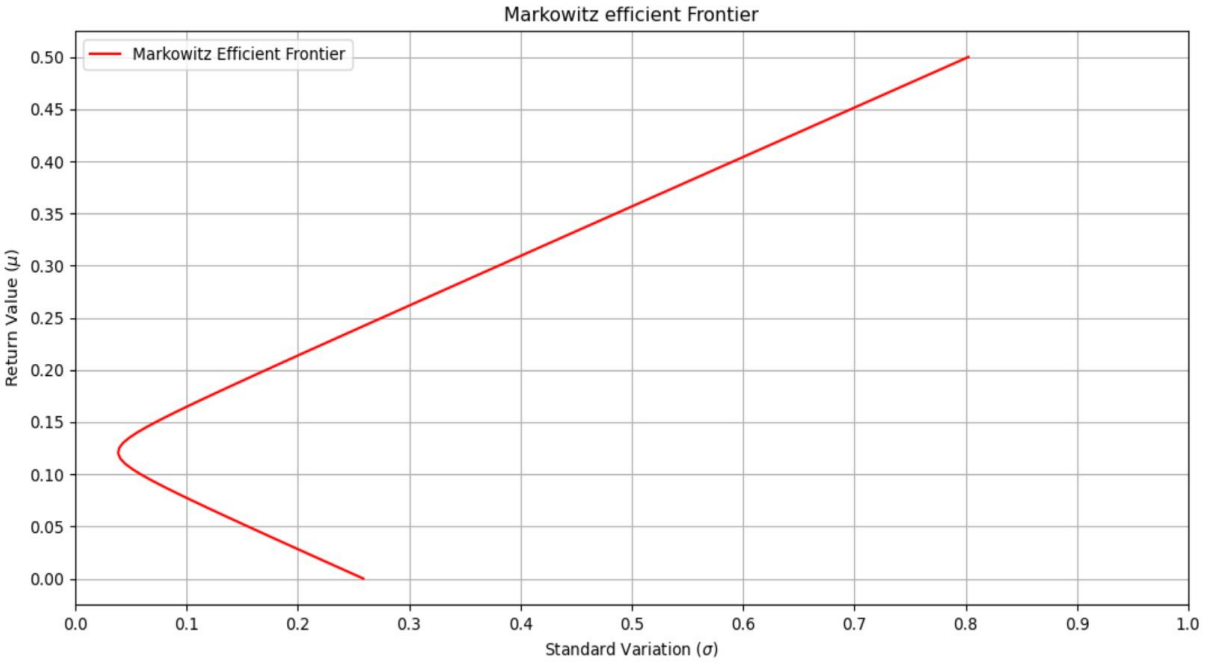
Question 1:

i. The Markowitz efficient frontier for the given mean return vector and covariance matrix is shown below:



ii. The weights, return and risk of the portfolios for 10 different values on the efficient frontier are tabulated below:

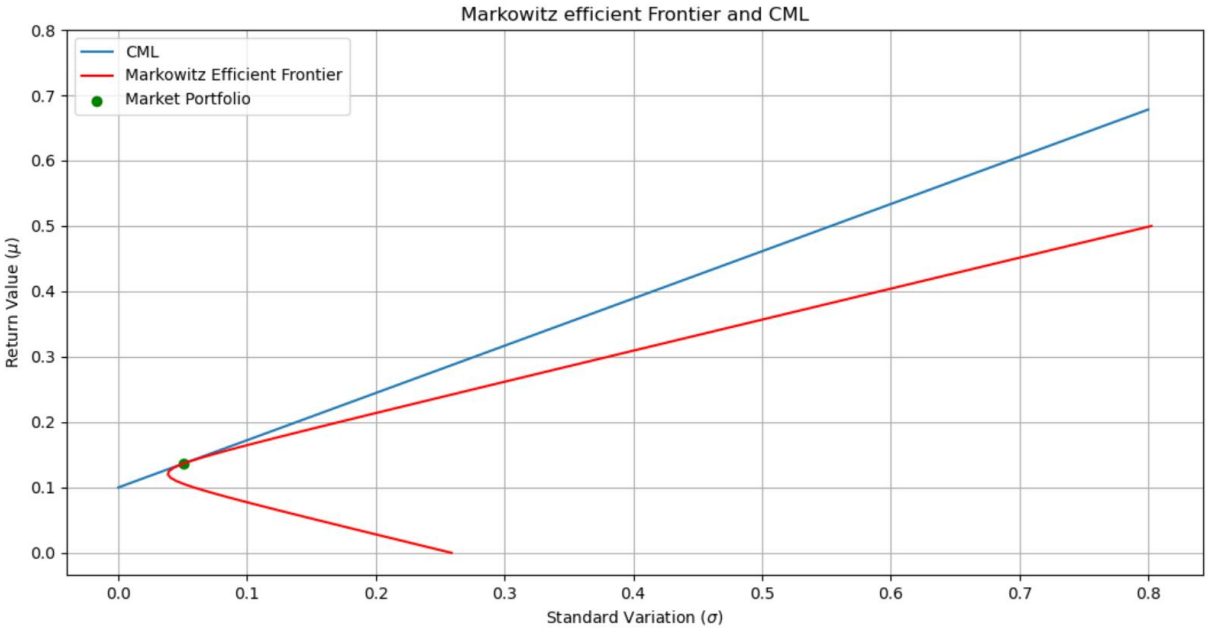
Return	Risk (SD)	w1	w2	w3
0.0	0.259	2.55	-0.45	-1.101
0.05	0.155	1.835	-0.165	-0.67
0.1	0.059	1.119	0.119	-0.239
0.15	0.072	0.404	0.404	0.193
0.2	0.171	-0.312	0.688	0.624
0.25	0.276	-1.028	0.972	1.055
0.3	0.381	-1.743	1.257	1.486
0.35	0.486	-2.459	1.541	1.917
0.4	0.591	-3.174	1.826	2.349
0.45	0.697	-3.89	2.11	2.78
0.5	0.803	-4.606	2.394	3.211

iii. For a 15% risk, the maximum return is 0.1896
Corresponding Portfolio: w1 = -0.1624 w2 = 0.6287 w3 = 0.5338

For a 15% risk, the minimum return is 0.0524
Corresponding Portfolio: w1 = 1.7998 w2 = -0.1512 w3 = -0.6486

iv. For a 18% return, the minimum risk is 13.0568 %
Corresponding Portfolio: w1 = -0.0257 w2 = 0.5743 w3 = 0.4514

v. <u>Market Portfolio:</u>
For a 10% risk free return, the return on market portfolio is 0.1367
For a 10% risk free return, the risk on market portfolio is 5.0811 %
Corresponding Portfolio: w1 = 0.5938 w2 = 0.3281 w3 = 0.0781

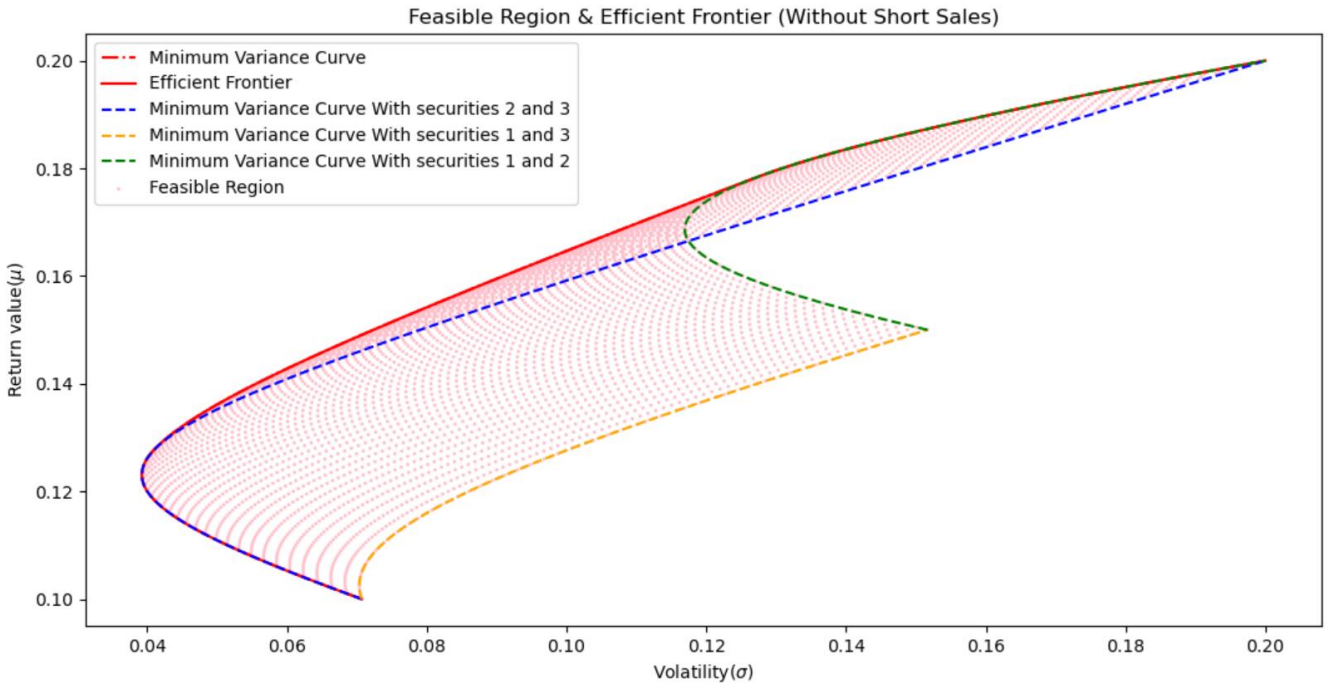


vi. For a 10% risk free return, the required portfolio is:
Corresponding Portfolio (Risky Asset): w1 = 1.1685 w2 = 0.6458 w3 = 0.1538
Corresponding Portfolio (RiskFree Asset): w = -0.9681

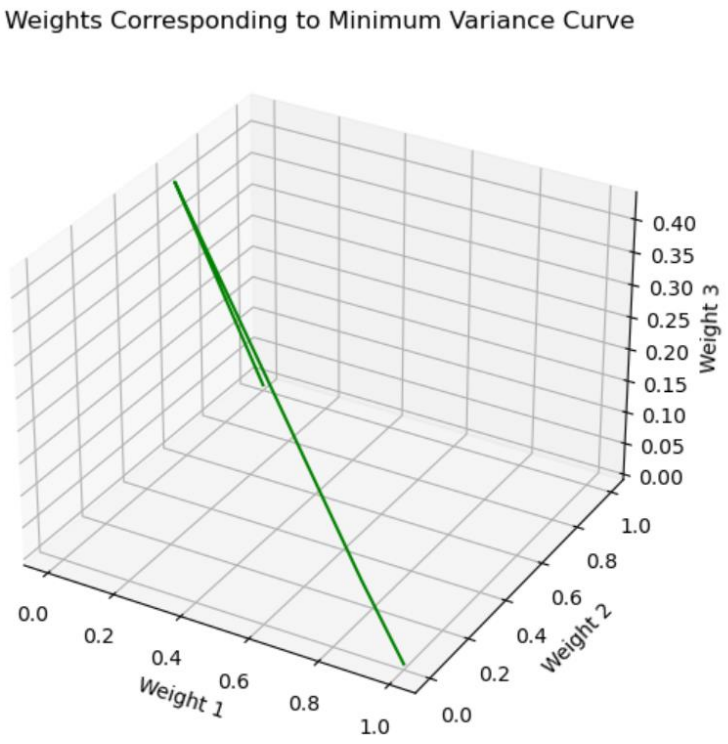
For a 25% risk free return, the required portfolio is:
Corresponding Portfolio (Risky Asset): w1 = 2.9213 w2 = 1.6144 w3 = 0.3844
Corresponding Portfolio (RiskFree Asset): w = -3.9202

Question 2:

- Assuming short selling is not allowed the efficient frontier, the minimum variance curve and the feasible region for the given mean return vector and covariance matrix were plotted in the same graph and is shown below. Also the minimum variance curves taking two-securities at a time were also plotted in the same plot.

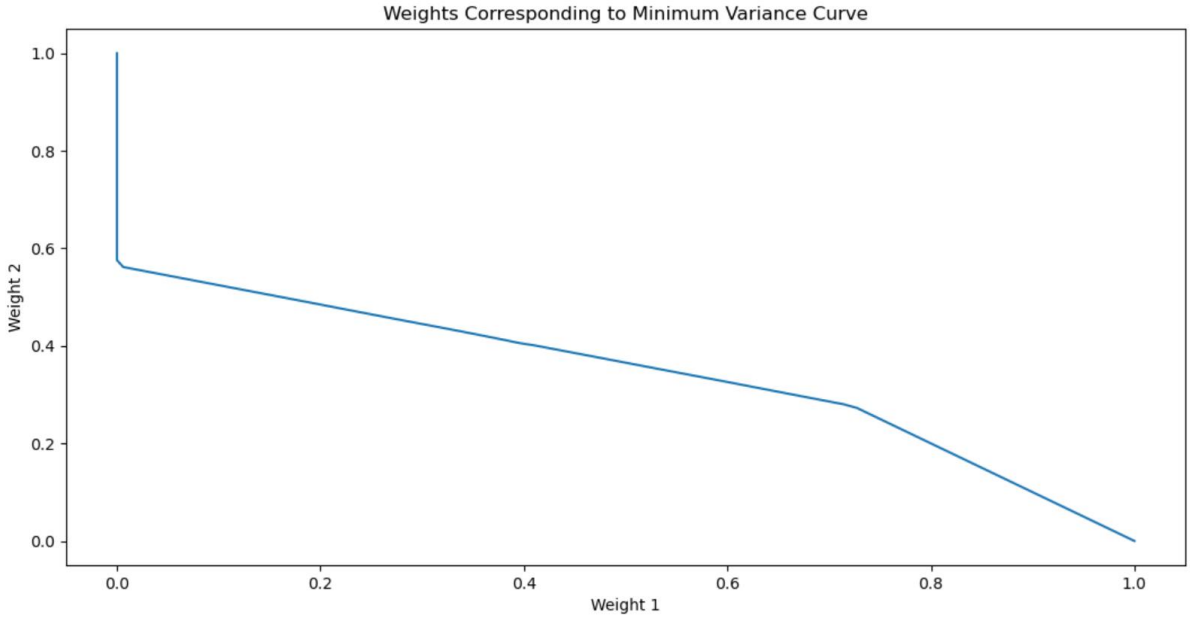


- Weights of securities corresponding to Minimum Variance Curve with 3-securities:
  Equation: w1+w2+w3=1



- Plotting weights of two securities corresponding to the Minimum Variance Curve of the portfolio with 3 securities:
  Equations:

  w1=0, 0.569≤ w2≤1
  w1 = 2.484w2 - 1.413, 0.278≤ w2≤0.569
  w1 = 1 – 0.996w2, 0≤ w2≤0.278
  w3 = 1-(w1+w2)

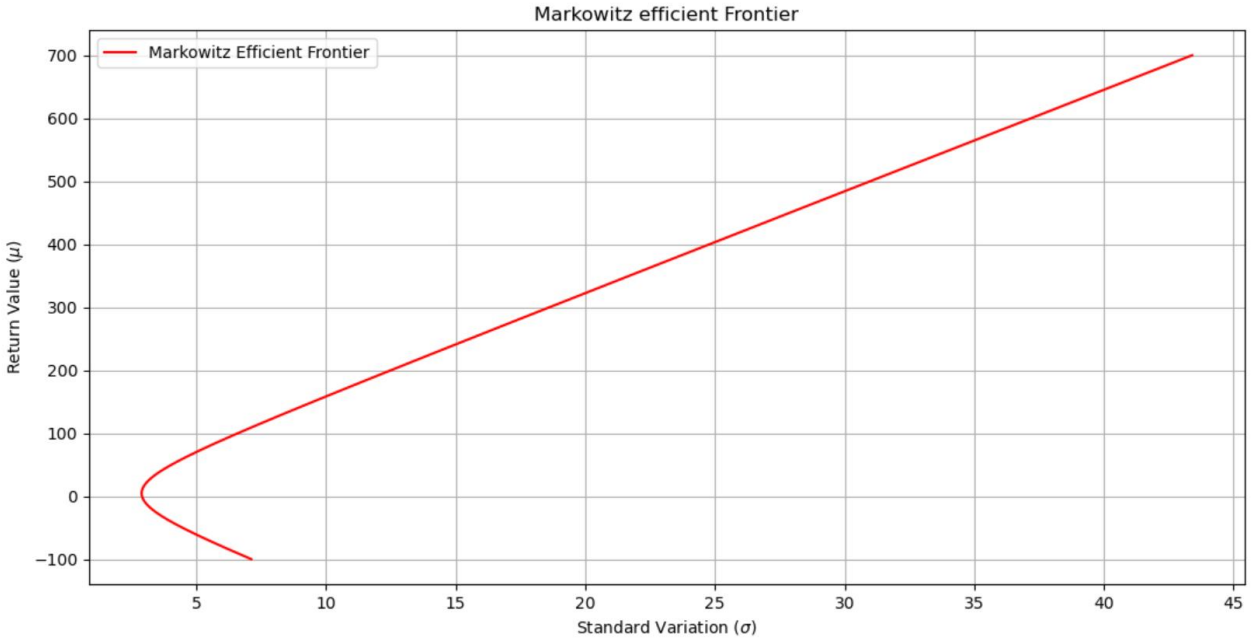


Question 3:

For this particular question, we collected the monthly stock prices of the following companies: ["Google","Airtel","Microsoft","Apple","Tesla","SBI","Amazon","Infosys","Facebook","Reliance"].

Mean return vector (M): [[1143 98 117 55 133 20 1664 52 178 32]]
Covariance matrix: printed on the console and can be seen from the output once code is executed

i. The Efficient Frontier for the aforementioned assets is plotted below:



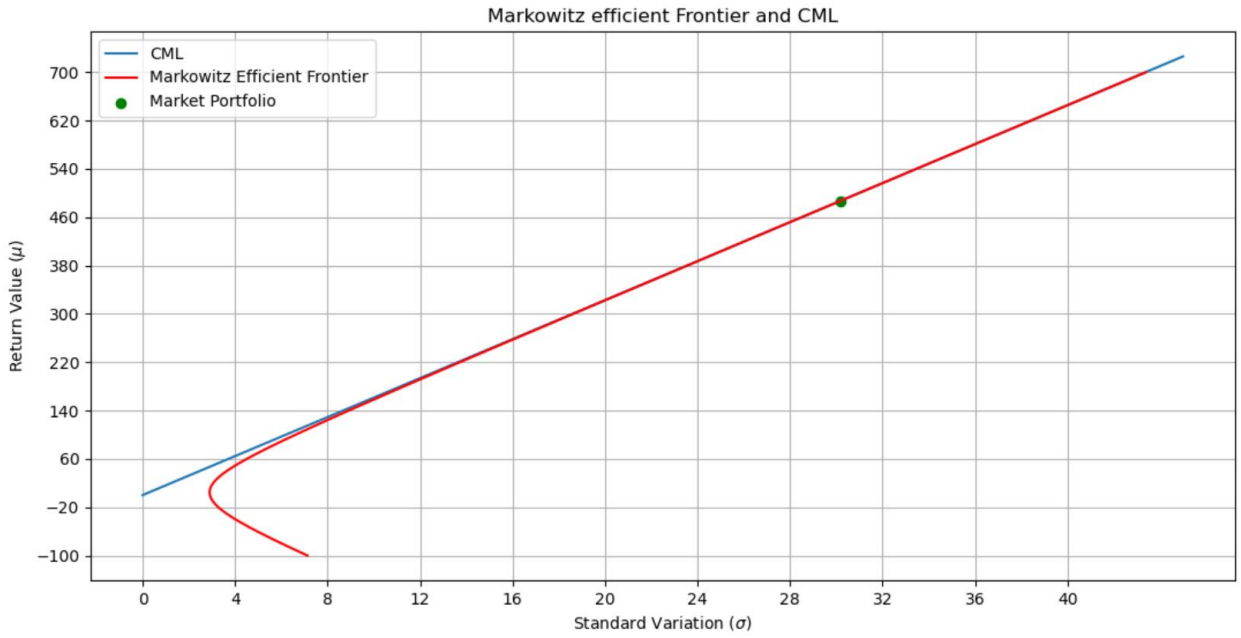
ii. **The Market Portfolio:**

For a 5% risk free return, the return 486.8074

For a 5% risk free return, the risk 30.1702

w1 = 0.3562 , w2 = 2.0556 , w3 = -2.219 , w4 = -0.3661 , w5 = -0.1254,w6 = 0.1356 , w7 = 0.081 , w8 = -3.4991 , w9 = 0.4965 , w10 = 4.0846

iii. Capital Market Line and the Market Portfolio are plotted below:



iv.