Assignment 2: Due date: February 17, 2022 before 2.00 pm

Question 1 (30 Points) Score.....

At this moment, all of your assets are invested in asset A with the following return and risk characteristics:

$$E(r_A) = 10\%$$

$$\sigma_A = 10\%$$

Another asset (call it"B") becomes avaiable; the characteristics of B are as follows;

$$E(r_B) = 20\%$$

$$\sigma_B = 25\%$$

. Furthermore, the correlation of A's and B's return patterns is -1.

Questions:

(1) Using MATLAB to write down the syntax (.m file) for determining the optimal weight (w) of asset A and B in order to achieve the lowest variance, or, in other words, determining the optimal weight for the minimum-variance portfolio.

(2) Find out the Expected return and its variance of the min-variance portfolio using the MATLAB.

(3) By reallocating your portfolio to include some of asset B, how much additional return could you expect to receive if you wanted to maintain your portfolio's risk at $\sigma_p = 10\%$. (Hint: Solve for W_B, not for the W_A).

Note: You must submit both the.m file and your answer in the next page's supplied space.

1) Optimal weight for min-variance portfolio

$W_A = 0.7143$, $W_B = 0.2857$

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Asset_Pricing.mlx | Assignment 2.mlx

```
clc;
clear all;
close all;

%% Two assets : Expected return (R_bar)
c =[1.1 1.2]
%% the variance-covariance matrix (V)
%% Find cov from correlation and variance
cov = 0.25*-0.1
var_Ra = 0.1^2
var_Rb = 0.25^2
H = [0.1^2 -0.025; -0.025 0.25^2]
H_inv = inv(H)

e =ones(size(c))

alpha =e*H_inv*transpose(c)
sigma =c*H_inv*transpose(c)
delta =e*H_inv*transpose(e)

R_bar =alpha/delta
variance =1/delta
std =sqrt(variance)

w_mv = (1/delta)*e*H_inv
```

Command Window

```
delta =

   2.3539e+18


R_bar =

    1.1286


variance =

   4.2483e-19


std =

   6.5179e-10


w_mv =

    0.7143    0.2857
```

2) Expected Return of the min variance portfolio

$\bar{R}_p = R_{mv} = 1.1286$

Variance of the min variance portfolio

$\sigma^2_{mv} = 4.2483e-19$

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2. Find expected return and its variance of the min-variance portfolio.

```
%%%% or
R_bar =alpha/delta

%%%% Variance of the min-variance portfolio
variance =1/delta
```

3. Additional return that you expect if you maintain portfolio's risk = 10%

```
%%%% W_b1 is a new weight on asset B
syms W_b1
variance_p = 0.01;
cov = 0.25*-0.1;
var_Ra = 0.1^2;
var_Rb = 0.25^2;
sol = solve(variance_p == (((1-W_b1)^2)*var_Ra) + ((W_b1^2)*(var_Rb)) + (2*(
```

Command Window

```
%%%% Find the new expected return
R_bar_new = W_a1*0.1 + W_b1*0.2

%%%%% Find Additional Return
Additional_Return = R_bar_new - 0

R_bar =

    1.1286

variance =

    4.2483e-19

ans =

0.571428571428571428571428571428

W_b1 =
```

3. Additional Return

$= E(R_{p_{new}}) - E(R_{p_{old}})$

$= 0.5714 - 0.1286$

$= 0.0285 = 2.85\%$

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3. Additional return that you expect if you maintain portfolio's risk = 10%

```
%%%% W_b1 is a new weight on asset B
syms W_b1
variance_p = 0.01;
cov = 0.25*-0.1;
var_Ra = 0.1^2;
var_Rb = 0.25^2;
sol = solve(variance_p == (((1-W_b1)^2)*var_Ra) + ((W_b1^2)*(var_Rb)) + (2*(
vpa(sol)
%%%% From running the code above, W_b1 = 0.571428571428571428571428571428571

%%%% Find W_a1 (new weight on asset A)
W_b1 = 0.571428571428571428571428571428571
W_a1 = (1- W_b1)

%%%% Find the new expected return of portfolio
R_bar_new = W_a1*0.1 + W_b1*0.2

%%%%% Find Additional Return
Additional_Return = R_bar_new - 0.1286
```

Command Window

```
ans =

0.571428571428571428571428571428571

W_b1 =

    0.5714

W_a1 =

    0.4286

R_bar_new =

    0.1571

Additional_Return =

    0.0285
```