Homework 1 : **Name :** Siri Chandana Pisupati **ID :** 9971282366

2.
Here we need to find the Value at Risk if per annum is considered as huge amount. since no cutoff value is mentioned, P[R] < 0 will be the VaR .
The weights are given in the ration 2:1:3:1:2. Hence they are taken as follows

ws1 = 2/9
w22 = 1/9
ws2 = 1/9
ws3 = 3/9
ws4 = 1/9
ws5 = 2/9

The means are taken as

```
> ms1 = 0.05
> ms2 = 0.04
> ms3 = 0.05
> ms4 = 0.04
> ms5 = 0.03
```

The standard deviations are taken as

```
> ss1 = 0.2828421
> ss2 = 0.2449490
> ss3 = 0.3464102
> ss4 = 0.2828427
> ss5 = 0.20
```

The given correlation matrix is converted to covariance matrix as follows

```
> std_second = c(ss1, ss2, ss3, ss4, ss5)     //standard deviations
> b_second = std_second %*% t(std_second)
> as_cov = b_second * as
> as_cov                                      //covariance matrix
```

1. Generating the covariance matrix and extracting co-variances
2. Calculating variance by multiplying vector of weights, co-variance matrix and transpose of the weights.
3. Finding standard deviation as the root of variance.
4. Finding mean by w1R1+w2R2+w3R3+w4R4+w5R5
5. Finding the P[R<0] = p[z < (0-mean)/standard deviation)]

A: 0.007821113

The screenshots of program execution in R is attached below.

```
> ws1 = 2/9
> w22 = 1/9
> ws2 = 1/9
> ws3 = 3/9
> ws4 = 1/9
> ws5 = 2/9
> ms1 = 0.05
> ms2 = 0.04
> ms3 = 0.05
> ms4 = 0.04
> ms5 = 0.03
> ss1 = 0.2828421
> ss2 = 0.2449490
> ss3 = 0.3464102
> ss4 = 0.2828427
> ss5 = 0.20
>
> as = matrix(c(1, -0.2886751, 0.1020621, -0.1250000, 0, -0.2886751, 1, 0.2357023, -0.28867
51, 0, 0.1020621, 0.2357023, 1, 0.2041241, -0.2886751, -0.125, -0.2886751, 0.2041241, 1, 0,
 0, 0, -0.2886751, 0, 1),5)
> as
           [,1]       [,2]       [,3]       [,4]       [,5]
[1,]  1.0000000 -0.2886751  0.1020621 -0.1250000  0.0000000
[2,] -0.2886751  1.0000000  0.2357023 -0.2886751  0.0000000
[3,]  0.1020621  0.2357023  1.0000000  0.2041241 -0.2886751
[4,] -0.1250000 -0.2886751  0.2041241  1.0000000  0.0000000
[5,]  0.0000000  0.0000000 -0.2886751  0.0000000  1.0000000
> std_second = c(ss1, ss2, ss3, ss4, ss5)
> b_second = std_second %*% t(std_second)
> as_cov = b_second * as
> as_cov
             [,1]        [,2]         [,3]         [,4]  [,5]
[1,]  0.079999654 -0.01999996  0.009999982 -0.009999978  0.00
[2,] -0.019999956  0.06000001  0.020000008 -0.019999999  0.00
[3,]  0.009999982  0.02000001  0.120000027  0.019999997 -0.02
[4,] -0.009999978 -0.02000000  0.019999997  0.079999993  0.00
[5,]  0.000000000  0.00000000 -0.020000000  0.000000000  0.04
> mat_1 = matrix(c(ws1, ws2, ws3, ws4, ws5),1)
> mat_1
          [,1]      [,2]      [,3]      [,4]      [,5]
[1,] 0.2222222 0.1111111 0.3333333 0.1111111 0.2222222
> mat_1 = matrix(c(ws1, ws2, ws3, ws4, ws5),5)
> mat_1 = matrix(c(ws1, ws2, ws3, ws4, ws5),1)
> mat_1
```

```
          [,1]      [,2]      [,3]      [,4]      [,5]
[1,] 0.2222222 0.1111111 0.3333333 0.1111111 0.2222222
> mat_2 = matrix(c(ws1, ws2, ws3, ws4, ws5),5)
> mat_2
          [,1]
[1,] 0.2222222
[2,] 0.1111111
[3,] 0.3333333
[4,] 0.1111111
[5,] 0.2222222
> var_s = mat_1 %*% as_cov %*% mat_2
> var_s
           [,1]
[1,] 0.02049381
> std_s = sqrt(var_s)
> std_s
          [,1]
[1,] 0.1431566
> mu_s = ws1*ms1 + ws2*ms2 + ws3*ms3 + ws4*ms4 +ws5*ms5
> mu_s
[1] 0.04333333
> pr_s = pnorm((0-mu_s)/std_s), mu_s, std_s)
Error: unexpected ',' in "pr_s = pnorm((0-mu_s)/std_s),"
> pr_s = pnorm((0-mu_s)/std_s, mu_s, std_s)
> pr_s
            [,1]
[1,] 0.007821113
```

1.

Given stock investments are 25000, 40000, 35000 => the weights are in the ratio 5:8:7. The probability of loss P[R] needs to be found.
w1 = 1/4
w2 = 2/5
w3 = 7/20.

1. For the given matrix covariance is calculated as follows in R

```
std = c(s1, s2, s3)            //standard deviations
b = std %*% t(std)
a_covariance = b * a           //covariance matrix
```

2. The covariances are extracted from the matrix.
3. The standard deviation is found by finding the root of variance by using
variance = w1^2*s1^2 + w2^2*s2^2 + w3^2*s3^2 + 2*w1*w2*s12 + 2*w1*w3*s13 + 2*w2*w3*s23

4. Mean of portfolio return is calculated by R = w1R1 + w2R2 + w3R3
5. Since here investment is given as 100000$, std = std * investment and
   mean_investment = mean of portfolio return * investment.

6. Probability of loss P[R] = P[z < (0-mean_investment)/std]
A : 0.2249176
The screenshot of execution in R is as shown below.

```
> a = matrix(c(1,1/6,1/5,1/6,1,-1/5,1/5,-1/5,1),3)
> a
          [,1]       [,2] [,3]
[1,] 1.0000000  0.1666667  0.2
[2,] 0.1666667  1.0000000 -0.2
[3,] 0.2000000 -0.2000000  1.0
> s1 = 0.14
> s2 = 0.04
> s3 = 0.08
> std = c(s1, s2, s3)
> b = std %*% t(std)
> a_covariance = b * a
> a_covariance
             [,1]          [,2]     [,3]
[1,] 0.0196000000  0.0009333333  0.00224
[2,] 0.0009333333  0.0016000000 -0.00064
[3,] 0.0022400000 -0.0006400000  0.00640


> s12 = a_covariance[1,2]
> s13 = a_covariance[1,3]
> s23 = a_covariance[2,3]

> w1 = 1/4
> w2 = 2/5
> w3 = 7/20
> variance = w1^2*s1^2 + w2^2*s2^2 + w3^2*s3^2 + 2*w1*w2*s12 + 2*w1*w3*s13 + 2*w2*w3*s23
> sig = sqrt(variance)
> sig
[1] 0.05161847
> mu = w1*(0.05) + w2*(0.04) + w3*(0.03)
> mu
[1] 0.039
> inv = 100000
> sig = sig * inv
> sig
[1] 5161.847
> mu = mu * inv
> mu
[1] 3900
> pr = pnorm((0-mu)/sig, mu, sig)
> pr
[1] 0.2249176
```