

Market	Security	$r_i$	risk	Correlation <sub>A,B</sub>
I	A	0.22	0.3	0.15
	B	0.31	0.32	
II	A	0.26	0.29	-0.06
	B	0.34	0.33	
III	A	0.18	0.2	0.09
	B	0.41	0.38	

Market	Rp
I	0.261589
II	0.295149
III	0.224674

3.056235  
-3.05623  
0.537897

I Market Cov\_M

0.09 0.0144  
0.0144 0.1024

Sys Eq

0.18	0.0288	1
0.0288	0.2048	1
1	1	0

3.056235 -3.05623 0.537897311  
-3.05623 3.056235 0.462102689  
0.537897 0.462103 -0.110130073

Proof 1.00 0.00 0.00  
0.00 1.00 0.00  
0.00 0.00 1.00

II Market Cov\_M

0.0841 -0.00574  
-0.00574 0.1089

Sys Eq

0.1682	-0.01148	1
-0.01148	0.2178	1
1	1	0

Inv Matr

2.445179 -2.44518 0.560640441  
-2.44518 2.445179 0.439359559  
0.56064 0.43936 -0.089254117

VRS

0  
0  
1

wi

w1 0.537897  
w2 0.462103  
lambda1 -0.11013

Proof 1

Market III Cov\_M

0.04 0.00684  
0.00684 0.1444

Sys Eq

0.08	0.01368	1
0.01368	0.2888	1
1	1	0

Inv\_M

2.928772 -2.92877 0.805763824  
-2.92877 2.928772 0.194236176  
0.805764 0.194236 -0.067118257

VRS

0  
0  
1

w1 0.56064  
w2 0.43936  
lambda1 -0.08925

Proof 1

VRS

0  
0  
1

w1 0.805764  
w2 0.194236  
lambda1 -0.06712

Proof 1

Sigma\_p

0.234659	1.114761	0.897053
0.211251	1.397146	0.715745
0.183192	1.226445	0.815365

Exp\_port\_ret

Rp 0.3

-3.05623	0.537897
3.056235	0.462103
0.462103	-0.11013

Sys Eq

0.18	0.0288	1	0.22
0.0288	0.2048	1	0.31
1	1	0	0
0.22	0.31	0	0

Inv\_M

0	2.52E-15	3.444444	-11.1111
0	-2.5E-15	-2.44444	11.11111
3.444444	-2.44444	-2.87432	10.56691
-11.1111	11.11111	10.56691	-40.3951

Rp

Sigma\_p

0.261589	0.234659
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Rp 0.3

Sys Eq

0.1682	-0.01148	1	0.26
-0.01148	0.2178	1	0.34
1	1	0	0
0.26	0.34	0	0

Inv\_M

0	-3.9E-15	4.25	-12.5
0	3.87E-15	-3.25	12.5
4.25	-3.25	-5.65587	18.86038
-12.5	12.5	18.86038	-63.9012

Rp

Sigma\_p

0.295149	0.211251
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Sys Eq

0.08	0.01368	1	0.18
0.01368	0.2888	1	0.41
1	1	0	0
0.18	0.41	0	0

Inv\_M

0	8.07E-16	1.782609	-4.34783
0	-8.1E-16	-0.78261	4.347826
1.782609	-0.78261	-0.39293	1.450147
-4.34783	4.347826	1.450147	-6.45444

Rp

Sigma\_p

0.224674	0.183192
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VRS	
	0
	0
	1
	0.3

w1 0.111111  
w2 0.888889  
lambda1 0.295753  
lambda2 -1.5516

proof 1

Rp	Sigma_p
0.3	0.291315

VRS	
	0
	0
	1
	0.3

w1 0.5  
w2 0.5  
lambda1 0.002242  
lambda2 -0.31

proof 1

Rp	Sigma_p
0.3	0.213023

VRS	
	0
	0
	1
	0.3

w1 0.478261  
w2 0.521739  
lambda1 0.042115  
lambda2 -0.48619

proof 1

Rp	Sigma_p
0.3	0.22775

	Company 1	Company 2	Company 3	Correlation	
$\mu$	0.8	0.3	0.6	$\sigma_{1,2}$	-0.1
$\sigma$	1.2	0.8	1.1	$\sigma_{1,3}$	-0.5
				$\sigma_{2,3}$	0.3

covar\_m

	Company 1	Company 2	Company 3
Company 1	1.44	-0.096	-0.66
Company 2	-0.096	0.64	0.264
Company 3	-0.66	0.264	1.21

System of Eq

2.88	-0.192	-1.32	1
-0.192	1.28	0.528	1
-1.32	0.528	2.42	1
1	1	1	0
0.2226909	-0.2543595	0.031669	0.351616
-0.2543595	0.6687465	-0.41439	0.313964
0.0316686	-0.414387	0.382718	0.33442
0.3516158	0.3139638	0.33442	-0.51094

VRS
0
0
0
1

wi

w1
w2
w3

lambda1

Proof

Rp

Sigma\_p

covar\_m

	Company 1	Company 2	Company 3
Company 1	1.44	-0.096	-0.66
Company 2	-0.096	0.64	0.264
Company 3	-0.66	0.264	1.21

System of Eq

2.88	-0.192	-1.32	1	0.8
-0.192	1.28	0.528	1	0.3
-1.32	0.528	2.42	1	0.6
1	1	1	0	0
0.8	0.3	0.6	0	0
0.0760932	0.0507288	-0.12682	-0.34729	1.213095
0.0507288	0.0338192	-0.08455	1.768474	-2.5246
-0.126822	-0.084548	0.21137	-0.42118	1.311509
-0.3472894	1.7684737	-0.42118	-3.84297	5.783435
1.2130948	-2.5246035	1.311509	5.783435	-10.0384



1.00	0.00	0.00	0.00
0.00	1.00	0.00	0.00
0.00	0.00	1.00	0.00
0.00	0.00	0.00	1.00

0.351615772  
0.31396383  
0.334420397  
-0.510937444

0.351616 0.313964 0.33442

1  
step by step matric-multip product of vetors  
0.576134005 0.576134005 0.576134005  
0.505439138 0.505439138 0.505439138

0.255469 0.255469 0.255469

Var\_P 0.255469

0.351616 0.313964 0.33442

0.351615772	0.178032	-0.0106	-0.07761
0.31396383	-0.0106	0.063087	0.027719
0.334420397	-0.07761	0.027719	0.135323

Var\_P 0.255469

VRS

0  
0  
0  
1  
1.5

1.472352802 -2.01843 1.546079

wi			
w1	1.472352802	3.121664794	0.285297
w2	-2.018431465	0.285296949	2.607402
w3	1.546078663	-1.502406346	-0.82385
lambda1	4.832181812		2.892335
lambda2	-9.274091109		

Var\_P 4.539477

Proof 1

Rp 1.5

1.472353 -2.01843

Sigma\_P 2.130604944 2.130604944

2.130604944

1.472353

3.121665 0.285297

-2.01843

0.285297 2.607402

1.546079

-1.50241 -0.82385





-1.50241  
-0.82385  
2.892335  
  
4.539477

	Sec <sub>1</sub>	Sec <sub>2</sub>	Sec <sub>3</sub>	Sec <sub>4</sub>	Sec <sub>5</sub>	Sec <sub>6</sub>	Sec <sub>7</sub>	r <sub>i</sub> (%)
Sec <sub>1</sub>	80.5	82.7	85.3	85.1	123.9	22	3.5	1.9
Sec <sub>2</sub>	82.7	184.7	131.5	69.4	49.5	58	-9.9	6.1
Sec <sub>3</sub>	85.3	131.5	374.2	384.5	366.5	103.8	343.5	2.9
Sec <sub>4</sub>	85.1	69.4	384.5	684.8	599.1	51.6	502.7	4
Sec <sub>5</sub>	123.9	49.5	366.5	599.1	871.4	-21.2	520.4	5.7
Sec <sub>6</sub>	22	58	103.8	51.6	-21.2	89.7	74.4	3.4
Sec <sub>7</sub>	3.5	-9.9	343.5	502.7	520.4	74.4	574.6	4.9

Global risk

Syst-Eq

161	165.4	170.6	170.2	247.8	44	7	1
165.4	369.4	263	138.8	99	116	-19.8	1
170.6	263	748.4	769	733	207.6	687	1
170.2	138.8	769	1369.6	1198.2	103.2	1005.4	1
247.8	99	733	1198.2	1742.8	-42.4	1040.8	1
44	116	207.6	103.2	-42.4	179.4	148.8	1
7	-19.8	687	1005.4	1040.8	148.8	1149.2	1
1	1	1	1	1	1	1	0
0.077542	-0.00619	0.008788	-0.00971	-0.03769	-0.07775	0.045002	2.1372
-0.00619	0.007803	-0.00362	0.000167	0.001056	-0.00048	0.001254	0.044435
0.008788	-0.00362	0.007544	-0.00229	-0.00426	-0.00879	0.002623	-0.29067
-0.00971	0.000167	-0.00229	0.004278	0.004072	0.01066	-0.00718	-0.23027
-0.03769	0.001056	-0.00426	0.004072	0.02058	0.040175	-0.02394	-0.77333
-0.07775	-0.00048	-0.00879	0.01066	0.040175	0.086382	-0.0502	-1.1224
0.045002	0.001254	0.002623	-0.00718	-0.02394	-0.0502	0.032436	1.235036
2.1372	0.044435	-0.29067	-0.23027	-0.77333	-1.1224	1.235036	-30.2875

VRS						
	0					
	0					
	0					
	0					
	0					
	0					
	0					
	1	2.1372	0.044435	-0.29067	-0.23027	-0.77333
wi						
w1	2.1372	367.6936	7.853678	-52.9898	-41.881	-204.776
w2	0.044435	7.853678	0.36468	-1.69843	-0.71011	-1.70094
w3	-0.29067	-52.9898	-1.69843	31.61554	25.73579	82.38249
w4	-0.23027	-41.881	-0.71011	25.73579	36.31192	106.6853
w5	-0.77333	-204.776	-1.70094	82.38249	106.6853	521.1259
w6	-1.1224	-52.7736	-2.89267	33.86451	13.33649	-18.4013
w7	1.235036	9.238319	-0.5433	-123.312	-142.966	-497.027
lambda1	-30.2875					
Proof	1					
Rp	0.39525	0.39525				
Sigma_P	3.891496	3.891496				

-1.1224 1.235036

-52.7736 9.238319

-2.89267 -0.5433

33.86451 -123.312

13.33649 -142.966

-18.4013 -497.027

113.0031 -103.134

-103.134 876.446

Var\_P 15.14374

Risky portfolio	A	B	C	D
$\mu_p$	6.20%	4%	7.50%	8.40%
$\sigma_p$	14.50%	9.70%	17%	20%

$r_f$

0.035

	1	2	3	4	5
$\mu_i$	0.2	0.4	0.5	0.6	0.8
Portfolio	0.8	0.6	0.5	0.4	0.2

$R_p$	1	2	3	4	5
A	0.0566	0.0512	0.0485	0.0458	0.0404
B	0.039	0.038	0.0375	0.037	0.036
C	0.067	0.059	0.055	0.051	0.043
D	0.0742	0.0644	0.0595	0.0546	0.0448

Sigma_P	1	2	3	4	5
A	0.116	0.087	0.0725	0.058	0.029
B	0.0776	0.0582	0.0485	0.0388	0.0194
C	0.136	0.102	0.085	0.068	0.034
D	0.16	0.12	0.1	0.08	0.04