Market	Security	r_i	risk	$\rho_{A,B}$
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 I CM

0.09	0.0144
0.0144	0.1024

VRS

0.18	0.0288	1		0
0.0288	0.2048	1		0
1	1	0		1

wi

3.056235	-3.05623	0.537897	w1	0.537897
-3.05623	3.056235	0.462103	w1	0.462103
0.537897	0.462103	-0.11013	lambda1	-0.11013
			proof	1

1	0	0	3.056235	-3.05623
0	1	0	-3.05623	3.056235
0	1.39E-17	1	0.537897	0.462103

Market II

CM

0.0841	-0.00574
-0.00574	0.1089

VRS

0.1682	-0.01148	1		0
-0.01148	0.2178	1		0
1	1	0		1

wi

2.445179	-2.44518	0.56064	w1	0.56064
-2.44518	2.445179	0.43936	w1	0.43936
0.56064	0.43936	-0.08925	lambda1	-0.08925
			proof	1

1	-1.1E-16	0	2.445179	-2.44518
-5.6E-17	1	0	-2.44518	2.445179
-1.4E-17	-1.4E-17	1	0.56064	0.43936

Market II

CM

0.04	0.00684

0.00684	0.1444					
				VRS		
0.08	0.01368	1		0		
0.01368	0.2888	1		0		
1	1	0		1		
				wi		
2.928772	-2.92877	0.805764	w1	0.805764		
-2.92877	2.928772	0.194236	w1	0.194236		
0.805764	0.194236	-0.06712	lambda1	-0.06712		
			proof	1		
1	-1.1E-16	4.44E-16			2.928772	-2.92877
0	1	-4.4E-16			-2.92877	2.928772
0	1.39E-17	1			0.805764	0.194236

Market	Rp	Sigma	
I	0.261589	0.234659	1.114761
II	0.295149	0.211251	1.397146
III	0.224674	0.183192	1.226445

		Rp	Sigma(P)
0.537897	0.537897	0.261589	0.234659
0.462103	0.462103		
-0.11013	-0.11013		

		Rp	Sigma(P)
0.56064	0.56064	0.295149	0.211251
0.43936	0.43936		
-0.08925	-0.08925		

		Rp	Sigma(P)
0.805764	0.805764	0.224674	0.183192
0.194236	0.194236		
-0.06712	-0.06712		

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

CM

1.44	-0.096	-0.66			
-0.096	0.64	0.264			
-0.66	0.264	1.21			
				VRS	
2.88	-0.192	-1.32	1	0	
-0.192	1.28	0.528	1	0	
-1.32	0.528	2.42	1	0	wi
1	1	1	0	1	
				wi	Rp
0.222691	-0.25436	0.031669	0.351616	0.351616	0.576134
-0.25436	0.668746	-0.41439	0.313964	0.313964	
0.031669	-0.41439	0.382718	0.33442	0.33442	
0.351616	0.313964	0.33442	-0.51094	-0.51094	

Proof 1

0.222691	-0.25436	0.031669	0.351616
-0.25436	0.668746	-0.41439	0.313964
0.031669	-0.41439	0.382718	0.33442
0.351616	0.313964	0.33442	-0.51094

Rp=15%

					VRS	
2.88	-0.192	-1.32	1	0.8		0
-0.192	1.28	0.528	1	0.3		0
-1.32	0.528	2.42	1	0.6		0
1	1	1	0	0		1
0.8	0.3	0.6	0	0		0.7
						wi
0.076093	0.050729	-0.12682	-0.34729	1.213095	w1	0.501877
0.050729	0.033819	-0.08455	1.768474	-2.5246	w2	0.001251
-0.12682	-0.08455	0.21137	-0.42118	1.311509	w3	0.496872
-0.34729	1.768474	-0.42118	-3.84297	5.783435	lambda1	0.205434
1.213095	-2.5246	1.311509	5.783435	-10.0384	lambda2	-1.24341

Proof 1

						0.351616	0.313964	0.33442
				0.351616		1.44	-0.096	-0.66
				0.313964		-0.096	0.64	0.264
				0.33442		-0.66	0.264	1.21
						0.178032	-0.0106	-0.07761
						-0.0106	0.063087	0.027719
						-0.07761	0.027719	0.135323
0.351616	0.313964	0.33442						
							Var(P)	0.255469
Var(p)	wT*V*w	sum_w+cv						
0.255469	0.255469	0.255469				0.255469		
0.505439						0.255469		
						0.255469		

				0.501877	0.001251	0.496872		
				1.44	-0.096	-0.66		
				-0.096	0.64	0.264		
				-0.66	0.264	1.21		
				0.362708	-6E-05	-0.16458		
				-6E-05	1E-06	0.000164		
				-0.16458	0.000164	0.298727		
Rp		Var(P)	SigmaP					
	0.7	0.332477	0.576608					

	Sec_1	Sec_2	Sec_3	Sec_4	Sec_5	Sec_6	Sec_7	r_i (%)
Sec_1	80.5	82.7	85.3	85.1	123.9	22	3.5	1.9
Sec_2	82.7	184.7	131.5	69.4	49.5	58	-9.9	6.1
Sec_3	85.3	131.5	374.2	384.5	366.5	103.8	343.5	2.9
Sec_4	85.1	69.4	384.5	684.8	599.1	51.6	502.7	4
Sec_5	123.9	49.5	366.5	599.1	871.4	-21.2	520.4	5.7
Sec_6	22	58	103.8	51.6	-21.2	89.7	74.4	3.4
Sec_7	3.5	-9.9	343.5	502.7	520.4	74.4	574.6	4.9

Min_varian

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

E(Rp)=5%

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
1.9	6.1	2.9	4	5.7	3.4	4.9	0

0.016039	0.007661	-0.00407	-0.00315	-0.00914	-0.02351	0.016171	2.286871
0.007661	0.004685	-0.00072	-0.00131	-0.00537	-0.01269	0.007746	0.010736
-0.00407	-0.00072	0.004856	-0.00092	0.001708	0.002544	-0.0034	-0.25938
-0.00315	-0.00131	-0.00092	0.003579	0.001028	0.004877	-0.00411	-0.24623

-0.00914	-0.00537	0.001708	0.001028	0.00733	0.015	-0.01055	-0.8428
-0.02351	-0.01269	0.002544	0.004877	0.015	0.038551	-0.02477	-1.2544
0.016171	0.007746	-0.0034	-0.00411	-0.01055	-0.02477	0.01892	1.305199
2.286871	0.010736	-0.25938	-0.24623	-0.8428	-1.2544	1.305199	-30.6517
-0.37867	0.085259	-0.07916	0.040381	0.175762	0.333946	-0.17751	0.921531

		2.1372	0.044435	-0.29067	-0.23027	-0.77333	-1.1224
		367.6936	7.853678	-52.9898	-41.881	-204.776	-52.7736
		7.853678	0.36468	-1.69843	-0.71011	-1.70094	-2.89267
		-52.9898	-1.69843	31.61554	25.73579	82.38249	33.86451
		-41.881	-0.71011	25.73579	36.31192	106.6853	13.33649
		-204.776	-1.70094	82.38249	106.6853	521.1259	-18.4013
		-52.7736	-2.89267	33.86451	13.33649	-18.4013	113.0031
		9.238319	-0.5433	-123.312	-142.966	-497.027	-103.134
VRS							
0							
0		367.6936	7.853678	-52.9898	-41.881	-204.776	-52.7736
0		7.853678	0.36468	-1.69843	-0.71011	-1.70094	-2.89267
0		-52.9898	-1.69843	31.61554	25.73579	82.38249	33.86451
0		-41.881	-0.71011	25.73579	36.31192	106.6853	13.33649
0		-204.776	-1.70094	82.38249	106.6853	521.1259	-18.4013
0		-52.7736	-2.89267	33.86451	13.33649	-18.4013	113.0031
1		9.238319	-0.5433	-123.312	-142.966	-497.027	-103.134
wi		Rp	Var(P)	Sigma(P)			
2.1372		0.39525	15.14374	3.891496			
0.044435						15.14374	
-0.29067							
-0.23027							
-0.77333							
-1.1224							
1.235036		2.1372					
-30.2875		0.044435					
		-0.29067					
		-0.23027					
		-0.77333					
		-1.1224					
		1.235036					
		-30.2875					
							0.3935
		VRS					
1.9		0			0.3935		80.5
6.1		0			0.43703		82.7
2.9		0			-0.65518		85.3
4		0			-0.04433		85.1
5.7		0			0.036015		123.9
3.4		0			0.415334		22
4.9		0			0.417629		3.5
0		1					
0		5					12.46483
							14.22203
		wi		Rp	Var(p)	Sigma(P)	-21.9915
-0.37867	1	0.3935		5	39.86213	6.313646	-1.48441
0.085259	2	0.43703					1.755887
-0.07916	3	-0.65518					3.595548
0.040381	4	-0.04433					0.57518

0.175762		5	0.036015
0.333946		6	0.415334
-0.17751		7	0.417629
0.921531	lambda1		-26.0441
-2.33151	lambda2		-10.736
	Proof		1

1.235036

9.238319
-0.5433
-123.312
-142.966
-497.027
-103.134
876.446

9.238319
-0.5433
-123.312
-142.966
-497.027
-103.134
876.446

0.43703	-0.65518	-0.04433	0.036015	0.415334	0.417629

82.7	85.3	85.1	123.9	22	3.5
184.7	131.5	69.4	49.5	58	-9.9
131.5	374.2	384.5	366.5	103.8	343.5
69.4	384.5	684.8	599.1	51.6	502.7
49.5	366.5	599.1	871.4	-21.2	520.4
58	103.8	51.6	-21.2	89.7	74.4
-9.9	343.5	502.7	520.4	74.4	574.6

14.22203	-21.9915	-1.48441	1.755887	3.595548	0.57518
35.27677	-37.6528	-1.34447	0.779106	10.52776	-1.80691
-37.6528	160.6291	11.167	-8.64797	-28.2459	-93.9892
-1.34447	11.167	1.345623	-0.95644	-0.95001	-9.30635
0.779106	-8.64797	-0.95644	1.130259	-0.31711	7.827232
10.52776	-28.2459	-0.95001	-0.31711	15.47344	12.90509
-1.80691	-93.9892	-9.30635	7.827232	12.90509	100.2183

Risky portfolio	A	B	C	D
r_p	6.20%	4%	7.50%	8.40%
σ_p	14.50%	9.70%	17%	20%

	1.	2.	3.	4.	5.
r_f	0.2	0.4	0.5	0.6	0.8
Portfolio	0.8	0.6	0.5	0.4	0.2

rf 0.035

Rp	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	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