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Homework 7

Problem 1

Q1. Mean and covariance

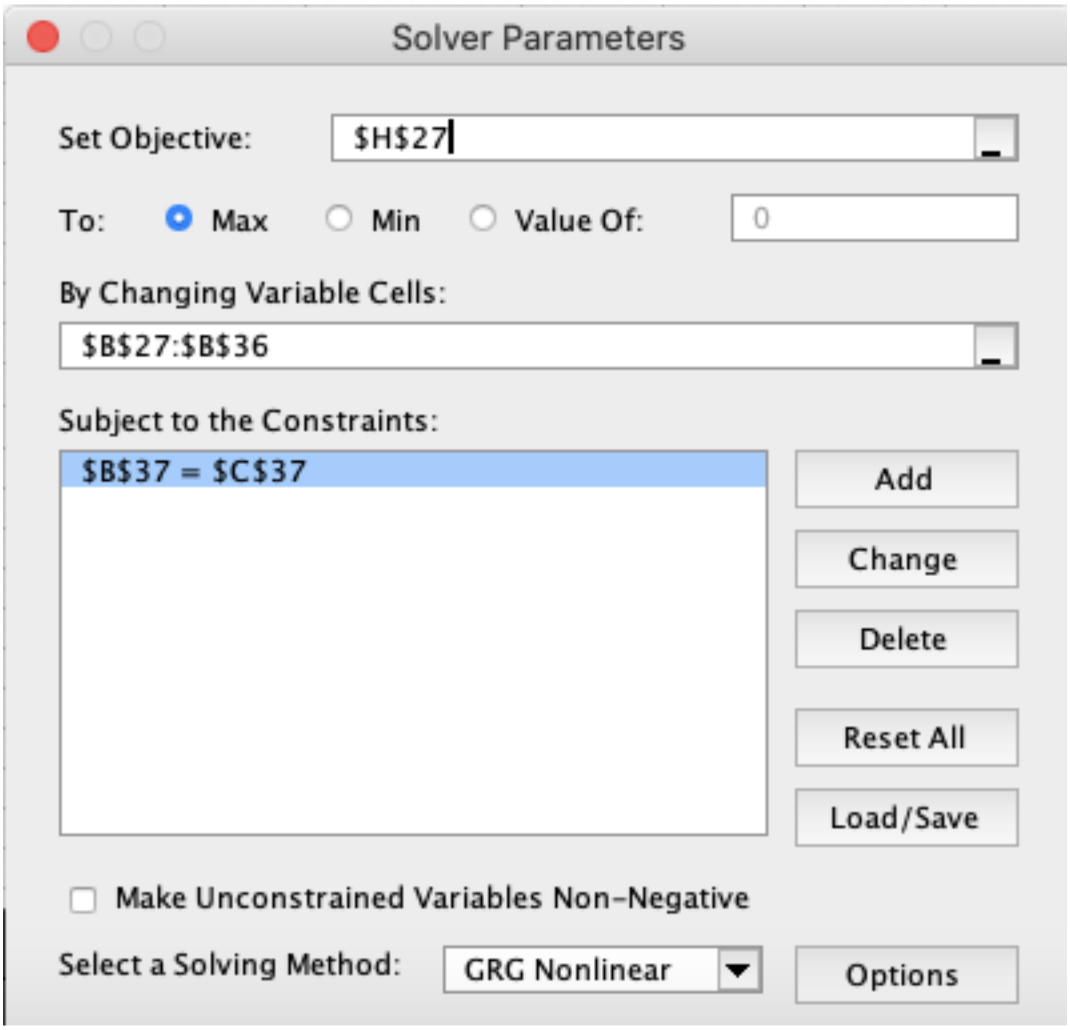
mean=
0.006583
0.0125
0.010917
0.0095
0.006
0.013583
0.00725
0.01125
0.015167
0.015667

covariance	1	2	3	4	5	6	7	8	9	10
1	0.00050308	0.00005529	-0.00009812	0.00025671	-0.00016942	0.00015333	0.00017669	-0.00002365	-0.00002593	-0.00005739
2	0.00005529	0.00095508	0.00035771	-0.00027200	-0.00013517	0.00024813	-0.00050546	-0.00000563	0.00041050	-0.00053067
3	-0.00009812	0.00035771	0.00063141	-0.00016646	0.00004992	0.00000030	0.00001719	-0.00020906	0.00029385	-0.00010053
4	0.00025671	-0.00027200	-0.00016646	0.00078308	-0.00002292	-0.00008129	0.00042046	-0.00014438	-0.00048317	0.00024150
5	-0.00016942	-0.00013517	0.00004992	-0.00002292	0.00066633	0.00004225	-0.00019442	-0.00003275	-0.00024658	-0.00025008
6	0.00015333	0.00024813	0.00000030	-0.00008129	0.00004225	0.00095124	0.00003827	-0.00020973	0.00003149	-0.00038447
7	0.00017669	-0.00050546	0.00001719	0.00042046	-0.00019442	0.00003827	0.00092669	-0.00017681	-0.00011504	0.00035983
8	-0.00002365	-0.00000563	-0.00020906	-0.00014438	-0.00003275	-0.00020973	-0.00017681	0.00076019	0.00008938	0.00041242
9	-0.00002593	0.00041050	0.00029385	-0.00048317	-0.00024658	0.00003149	-0.00011504	0.00008938	0.00071181	-0.00032969
10	-0.00005739	-0.00053067	-0.00010053	0.00024150	-0.00025008	-0.00038447	0.00035983	0.00041242	-0.00032969	0.00155956

Q2. Describe the efficient frontier in one-fund theorem

The total excel is here

covariance	1	2	3	4	5	6	7	8	9	10		riskless return		ri-r0
1	0.00050308	0.00005529	-0.00009812	0.00025671	-0.00016942	0.00015333	0.00017669	-0.00002365	-0.00002593	-0.00005739		0.005		0.001583
2	0.00005529	0.00095508	0.00035771	-0.00027200	-0.00013517	0.00024813	-0.00050546	-0.00000563	0.00041050	-0.00053067				0.0075
3	-0.00009812	0.00035771	0.00063141	-0.00016646	0.00004992	0.00000030	0.00001719	-0.00020906	0.00029385	-0.00010053				0.005917
4	0.00025671	-0.00027200	-0.00016646	0.00078308	-0.00002292	-0.00008129	0.00042046	-0.00014438	-0.00048317	0.00024150				0.0045
5	-0.00016942	-0.00013517	0.00004992	-0.00002292	0.00066633	0.00004225	-0.00019442	-0.00003275	-0.00024658	-0.00025008				0.001
6	0.00015333	0.00024813	0.00000030	-0.00008129	0.00004225	0.00095124	0.00003827	-0.00020973	0.00003149	-0.00038447				0.008583
7	0.00017669	-0.00050546	0.00001719	0.00042046	-0.00019442	0.00003827	0.00092669	-0.00017681	-0.00011504	0.00035983				0.00225
8	-0.00002365	-0.00000563	-0.00020906	-0.00014438	-0.00003275	-0.00020973	-0.00017681	0.00076019	0.00008938	0.00041242				0.00625
9	-0.00002593	0.00041050	0.00029385	-0.00048317	-0.00024658	0.00003149	-0.00011504	0.00008938	0.00071181	-0.00032969				0.010167
10	-0.00005739	-0.00053067	-0.00010053	0.00024150	-0.00025008	-0.00038447	0.00035983	0.00041242	-0.00032969	0.00155956				0.010667
	position		yT * C		r_head * y		object function							
1	-0.057087899		7.3567E-06		0.007897543		1.303757563E+00							
2	0.086636556		3.48467E-05											
3	-0.169415633		2.74904E-05		yT* C * y									
4	0.282967376		2.09078E-05		3.66936E-05									
5	0.252054809		4.64644E-06											
6	0.087761956		3.988E-05											
7	-0.043995097		1.04538E-05											
8	-0.091403559		2.90389E-05											
9	0.455411792		4.72366E-05											
10	0.197069698		4.95591E-05											
sum	1	1												
return	0.007897543													



rj -r0:

ri-r0
0.001583
0.0075
0.005917
0.0045
0.001
0.008583
0.00225
0.00625
0.010167
0.010667

Final portfolio:

	position
1	-0.057087899
2	0.086636556
3	-0.169415633
4	0.282967376
5	0.252054809
6	0.087761956
7	-0.043995097
8	-0.091403559
9	0.455411792
10	0.197069698
sum	1

Maximum sharpe ratio:

object function
1.303757563E+00

Return:

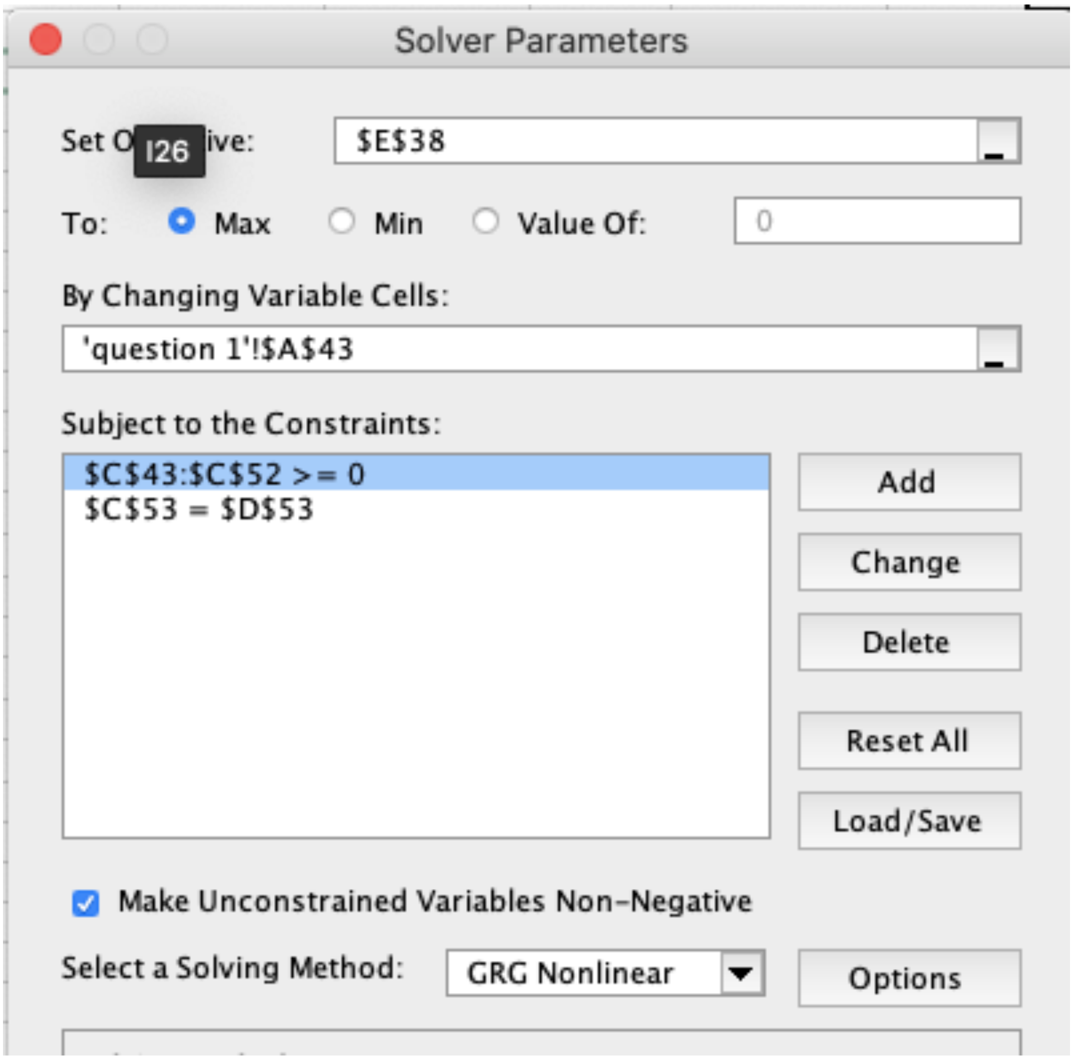
return	0.007897543

Q3:

When short is now allowed: we add one more constrain that yi >= 0.

The whole excel:

when short is not allowed							
object function		position		yT * C		r_head * y	return
1.158411	1	0		3.27123E-05		0.009521624	0.009521624
	2	0.059008006		5.32164E-05			
	3	0		9.19688E-05			
	4	0.294407038		3.19332E-05		yT* C * y	
	5	0.254909018		7.09301E-06		6.75612E-05	
	6	0.124457848		6.08999E-05			
	7	0		6.37758E-05			
	8	0.009224704		4.43466E-05			
	9	0.433967199		7.21374E-05			
	10	0.183881827		7.56884E-05			
	sum	1	1				



Position:

	position
1	0
2	0.059008006
3	0
4	0.294407038
5	0.254909018
6	0.124457848
7	0
8	0.009224704
9	0.433967199
10	0.183881827

Return:

return
0.009521624

Construct frontier using different portion of riskless assets.

Problem 2

When the distribution of different scenario are equal to 1/12.

The whole excel is here:

													E(R)
Portfolio 1	0.017	0.02	-0.024	-0.004	0.019	0.039	-0.03	0.025	0.021	0.054	-0.011	0.056	0.015167
Portfolio 2	0.0142	-0.0004	0.0146	0.0032	0.0158	0.0081	-0.0017	0.0105	0.0222	0.0053	0.0197	0.0186	0.010842
Portfolio 3	0.0172	0.0058	-0.013	-2.2E-19	0.0094	0.0366	-0.0088	0.0088	0.0266	0.0116	0.0186	0.0394	0.012683

	return1	return2	return3		return1	return2	return3		probability		initial capital
1	0.017	0.0142	0.0172		-0.03	-0.0017	-0.013		0.083333		100000
2	0.02	-0.0004	0.0058		-0.024	-0.0004	-0.0088		0.166667	0.1	
3	-0.024	0.0146	-0.013		-0.011	0.0032	-2.2E-19		0.25	0.2	
4	-0.004	0.0032	-2.2E-19		-0.004	0.0053	0.0058		0.333333	0.3	
5	0.019	0.0158	0.0094		0.017	0.0081	0.0088		0.416667		
6	0.039	0.0081	0.0366		0.019	0.0105	0.0094		0.5		
7	-0.03	-0.0017	-0.0088		0.02	0.0142	0.0116		0.583333		
8	0.025	0.0105	0.0088		0.021	0.0146	0.0172		0.666667		
9	0.021	0.0222	0.0266		0.025	0.0158	0.0186		0.75		
10	0.054	0.0053	0.0116		0.039	0.0186	0.0266		0.833333		
11	-0.011	0.0197	0.0186		0.054	0.0197	0.0366		0.916667		
12	0.056	0.0186	0.0394		0.056	0.0222	0.0394		1		

VaR		
portfolio1	portfolio2	portfolio3
2400	40	880
1100	-320	2.17E-14
400	-530	-580

The Expected return are:

													E(R)
Portfolio 1	0.017	0.02	-0.024	-0.004	0.019	0.039	-0.03	0.025	0.021	0.054	-0.011	0.056	0.015167
Portfolio 2	0.0142	-0.0004	0.0146	0.0032	0.0158	0.0081	-0.0017	0.0105	0.0222	0.0053	0.0197	0.0186	0.010842
Portfolio 3	0.0172	0.0058	-0.013	-2.2E-19	0.0094	0.0366	-0.0088	0.0088	0.0266	0.0116	0.0186	0.0394	0.012683

The situation of alpha = 0.1, 0.2, 0.3 lies in

probability	
0.083333	
0.166667	0.1
0.25	0.2
0.333333	0.3
0.416667	
0.5	
0.583333	
0.666667	
0.75	
0.833333	
0.916667	
1	

Calculate the VaR = return*initial asset

VaR		
portfolio1	portfolio2	portfolio3
2400	40	880
1100	-320	2.17E-14
400	-530	-580

Problem3

When the distribution of different assets are joint normal distribution, The whole excel is here:

10	0.108	-0.003	0.061	0.008	0.024	-0.013	-0.037	0.033	-0.009	-0.021	0.026	-0.009		0.01566667
												Portfolio 1	Portfolio 2	Portfolio 3
covariance	1	2	3	4	5	6	7	8	9	10		0	0.1	0
1	0.00050308	5.52917E-05	-9.812E-05	0.00025671	-0.0001694	0.00015333	0.00017669	-2.365E-05	-2.593E-05	-5.739E-05		0	0.1	0.2
2	5.5292E-05	0.000955083	0.00035771	-0.000272	-0.0001352	0.00024813	-0.0005055	-5.625E-06	0.0004105	-0.0005307		0	0.1	0.2
3	-9.812E-05	0.000357708	0.00063141	-0.0001665	4.9917E-05	2.9861E-07	1.7188E-05	-0.0002091	0.00029385	-0.0001005		0	0.1	0
4	0.00025671	-0.000272	-0.0001665	0.00078308	-2.292E-05	-8.129E-05	0.00042046	-0.0001444	-0.0004832	0.0002415		0	0.1	0
5	-0.0001694	-0.000135167	4.9917E-05	-2.292E-05	0.00066633	0.00004225	-0.0001944	-3.275E-05	-0.0002466	-0.0002501		0	0.1	0.2
6	0.00015333	0.000248125	2.9861E-07	-8.129E-05	0.00004225	0.00095124	3.8271E-05	-0.0002097	3.1486E-05	-0.0003845		0	0.1	0
7	0.00017669	-0.000505458	1.7188E-05	0.00042046	-0.0001944	3.8271E-05	0.00092669	-0.0001768	-0.000115	0.00035983		0	0.1	0.2
8	-2.365E-05	-5.625E-06	-0.0002091	-0.0001444	-3.275E-05	-0.0002097	-0.0001768	0.00076019	8.9375E-05	0.00041242		1	0.1	0.2
9	-2.593E-05	0.0004105	0.00029385	-0.0004832	-0.0002466	3.1486E-05	-0.000115	8.9375E-05	0.00071181	-0.0003297		0	0.1	0
10	-5.739E-05	-0.000530667	-0.0001005	0.0002415	-0.0002501	-0.0003845	0.00035983	0.00041242	-0.0003297	0.00155956				
	portfolio1	portfolio2	portfolio3		alpha	standard score								
return	0.01516667	0.010841667	0.01268333		0.1	1.28155157		initial asset						
vairance	0.00071181	5.81724E-05	0.00024094		0.2	0.84162123		100000						
std	0.02667968	0.007627085	0.01552234		0.3	0.52440051								
	cx1	cx2	cx3	VaR										
1	-2.593E-05	7.7059E-05	1.2185E-05		portfolio1	portfolio2	portfolio3							
2	0.0004105	5.77792E-05	0.00039316	0.1	1902.47245	-106.71635	720.934647							
3	0.00029385	7.76201E-05	0.00021484	0.2	728.752216	-442.25497	38.0598052							
4	-0.0004832	5.31542E-05	-0.0002295	0.3	-117.58265	-684.20192	-454.341							
5	-0.0002466	-2.92833E-05	-6.447E-05											
6	3.1486E-05	7.89507E-05	0.00020428											
7	-0.000115	9.47396E-05	-0.0001484											
8	8.9375E-05	4.59979E-05	8.5029E-05											
9	0.00071181	3.36597E-05	0.0003074											
10	-0.0003297	9.20472E-05	-0.0001866											

We got the standardized score:

alpha	standard score
0.1	1.28155157
0.2	0.84162123
0.3	0.52440051

We got the expected return and standard variation for different portfolio:

	portfolio1	portfolio2	portfolio3
return	0.01516667	0.010841667	0.01268333
vairance	0.00071181	5.81724E-05	0.00024094
std	0.02667968	0.007627085	0.01552234

Then we calculate the VaR = Mean – std*standard score

VaR			
	portfolio1	portfolio2	portfolio3
0.1	1902.47245	-106.71635	720.934647
0.2	728.752216	-442.25497	38.0598052
0.3	-117.58265	-684.20192	-454.341