Problem1:

closed_form_greeks		finite_diff_greeks		Diff
Delta of the call option is	0.083	Delta of the call option is	0.083	0
Delta of the put option is	-0.917	Delta of the put option is	-0.917	0
Gamma of the call option is	0.017	Gamma of the call option is	0.017	0
Gamma of the put option is	0.017	Gamma of the put option is	0.017	0
Vega of the call option is	6.939	Vega of the call option is	6.904	0.00504
Vega of the put option is	6.939	Vega of the put option is	6.904	0.00504
Theta of the call option is	-8.127	Theta of the call option is	-8.098	0.00357
Theta of the put option is	-1.941	Theta of the put option is	-1.913	0.01443
Rho of the call option is	-0.03	Rho of the call option is	-0.03	0
Rho of the put option is	-1.243	Rho of the put option is	-1.243	0
Carry Rho of the call option is	1.133	Carry Rho of the call option is	1.131	0.00177
Carry Rho of the put option is	-12.515	Carry Rho of the put option is	-12.516	-8E-05

The american call option value without dividend is	0.336	The american call option value with dividen	0.298
The american put option value without dividend is	14.037	The american put option value with dividen	14.559
Delta of the call option is	0.083	Delta of the call option is	0.069
Delta of the put option is	-0.917	Delta of the put option is	-0.938
Gamma of the call option is	0.017	Gamma of the call option is	0.017
Gamma of the put option is	0.017	Gamma of the put option is	0.017
Vega of the call option is	6.939	Vega of the call option is	5.97
Vega of the put option is	6.939	Vega of the put option is	5.478
Theta of the call option is	-8.127	Theta of the call option is	-7.058
Theta of the put option is	-1.941	Theta of the put option is	-0.239
Rho of the call option is	-0.03	Rho of the call option is	0.941
Rho of the put option is	-1.243	Rho of the put option is	-12.409
Carry Rho of the call option is	1.133	Sensitivity of dividend of the call option is	-0.025
Carry Rho of the put option is	-12.515	Sensitivity of dividend of the put option is	0.941

Problem 2:

PS：The simulation test may cause ES to be calculated as NA due to random reasons, please run it a few more times

Normal assumption:

Portfolio	Mean	VaR	ES
Call	8.739314	6.799001	6.800000
CallSpread	3.580737	4.589001	4.590000
CoveredCall	7.130872	-2.404679	0.242684
ProtectedPut	14.107179	-2.047161	-0.500281
Put	-0.310992	3.752352	4.132287
PutSpread	-0.170829	2.131864	2.429370
Stock	14.345658	1.472142	4.218320
Straddle	8.428322	1.515007	1.859695
SynLong	9.050306	11.433580	12.938951

Delta assumption:

Portfolio	Mean	VaR	ES
Call	0	15.06941	18.897649
CallSpread	0	2.971117	3.725901
CoveredCall	0	7.159315	8.97807
ProtectedPut	0	15.026724	18.844118
Put	0	4.23719	5.313607
PutSpread	0	2.105706	2.640641
Stock	0	19.257609	24.149818
Straddle	0	10.83222	13.584041
SynLong	0	19.3066	24.211256

Last week:

Portfolio	Mean	VaR	ES
Call	0.316611	6.093089	6.514194
CallSpread	-0.145261	3.570688	3.921484
CoveredCall	-0.295645	11.118065	14.552531
ProtectedPut	0.393193	7.895996	8.666316
Put	0.390926	5.089110	5.492737
PutSpread	0.229405	2.474291	2.730363
Stock	0.117074	15.290803	18.919740
Straddle	0.707537	1.593452	1.600015
SynLong	-0.074315	15.449849	19.063687

The preceding observations highlight a consistency between the outcomes of the previous week and those originating from the normal assumption. However, the results stemming from the delta normal assumption markedly surpass those arising from the other two hypotheses.

Problem 3:

Annual Return:

AAPL	0.170107
META	0.018103
UNH	0.288749
MA	0.249574
MSFT	0.168704
NVDA	0.322555
HD	0.128131
PFE	0.079988
AMZN	-0.042039
BRK-B	0.138703
PG	0.084942
XOM	0.684185
TSLA	-0.032708
JPM	0.103243
V	0.272443
DIS	-0.143945
GOOGL	-0.016931
JNJ	0.132214
BAC	-0.106247
CSCO	0.159239

The covariance matrix:

	AAPL	META	UNH	MA	MSFT	NVDA	HD	PFE	AMZN	BRK-B	PG	XOM	TSLA	JPM	V	DIS	GOOGL	JNJ	BAC	CSCO
AAPL	0.126738	0.139279	0.037576	0.081122	0.102675	0.170661	0.066172	0.032783	0.122252	0.055362	0.036906	0.037698	0.156009	0.058319	0.071338	0.087851	0.111616	0.022804	0.065946	0.066390
META	0.139279	0.406190	0.018151	0.101840	0.141181	0.237033	0.096984	0.045444	0.193966	0.061432	0.033255	0.021282	0.172348	0.073638	0.084713	0.126238	0.180699	0.021325	0.088300	0.075846
UNH	0.037576	0.018151	0.060886	0.031223	0.036463	0.046862	0.026235	0.031954	0.035459	0.028154	0.027895	0.026746	0.039632	0.033178	0.029713	0.022825	0.029831	0.022884	0.034481	0.028710
MA	0.081122	0.101840	0.031223	0.095774	0.079533	0.137081	0.056667	0.033596	0.096731	0.047515	0.030998	0.031071	0.098114	0.058211	0.082371	0.077518	0.078825	0.017383	0.063400	0.051727
MSFT	0.102675	0.141181	0.036463	0.079533	0.127647	0.175257	0.070782	0.035234	0.134157	0.052532	0.033754	0.031239	0.131657	0.056437	0.067972	0.088181	0.120001	0.020346	0.064950	0.060765
NVDA	0.170661	0.237033	0.046862	0.137081	0.175257	0.402237	0.111532	0.046690	0.221690	0.084224	0.041628	0.055293	0.292642	0.097994	0.118084	0.158202	0.186852	0.021941	0.113306	0.098069
HD	0.066172	0.096984	0.026235	0.056667	0.070782	0.111532	0.097821	0.033527	0.097067	0.042235	0.034512	0.015860	0.078047	0.043519	0.050107	0.064096	0.069352	0.022494	0.046540	0.048507
PFE	0.032783	0.045444	0.031954	0.033596	0.035234	0.046690	0.033527	0.070361	0.037936	0.031182	0.027458	0.019991	0.022702	0.031804	0.030737	0.024826	0.029369	0.027573	0.030827	0.029452
AMZN	0.122252	0.193966	0.035459	0.096731	0.134157	0.221690	0.097067	0.037936	0.244939	0.065928	0.030512	0.037616	0.187761	0.070934	0.083987	0.125137	0.149999	0.022907	0.085426	0.071893
BRK-B	0.055362	0.061432	0.028154	0.047515	0.052532	0.084224	0.042235	0.031182	0.065928	0.049984	0.024785	0.033883	0.061847	0.046821	0.042065	0.051399	0.056132	0.019199	0.050566	0.040426
PG	0.036906	0.033255	0.027895	0.030998	0.033754	0.041628	0.034512	0.027458	0.030512	0.024785	0.048759	0.004620	0.023824	0.029346	0.029337	0.027709	0.028033	0.023517	0.028399	0.034884
XOM	0.037698	0.021282	0.026746	0.031071	0.031239	0.055293	0.015860	0.019991	0.037616	0.033883	0.004620	0.120706	0.043579	0.029153	0.024338	0.035738	0.031272	0.006512	0.032721	0.023197
TSLA	0.156009	0.172348	0.039632	0.098114	0.131657	0.292642	0.078047	0.022702	0.187761	0.061847	0.023824	0.043579	0.464239	0.067761	0.091564	0.129878	0.143374	0.012796	0.083979	0.067252
JPM	0.058319	0.073638	0.033178	0.058211	0.056437	0.097994	0.043519	0.031804	0.070934	0.046821	0.029346	0.029153	0.067761	0.082445	0.052983	0.061665	0.059222	0.018809	0.082357	0.047038
V	0.071338	0.084713	0.029713	0.082371	0.067972	0.118084	0.050107	0.030737	0.083987	0.042065	0.029337	0.024338	0.091564	0.052983	0.082980	0.067703	0.066947	0.016759	0.058729	0.045200
DIS	0.087851	0.126238	0.022825	0.077518	0.088181	0.158202	0.064096	0.024826	0.125137	0.051399	0.027709	0.035738	0.129878	0.061665	0.067703	0.139415	0.095818	0.015301	0.072743	0.053124
GOOGL	0.111616	0.180699	0.029831	0.078825	0.120001	0.186852	0.069352	0.029369	0.149999	0.056132	0.028033	0.031272	0.143374	0.059222	0.066947	0.095818	0.161286	0.019740	0.069927	0.065086
JNJ	0.022804	0.021325	0.022884	0.017383	0.020346	0.021941	0.022494	0.027573	0.022907	0.019199	0.023517	0.006512	0.012796	0.018809	0.016759	0.015301	0.019740	0.031381	0.017875	0.022045
BAC	0.065946	0.088300	0.034481	0.063400	0.064950	0.113306	0.046540	0.030827	0.085426	0.050566	0.028399	0.032721	0.083979	0.082357	0.058729	0.072743	0.069927	0.017875	0.100298	0.048803
CSCO	0.066390	0.075846	0.028710	0.051727	0.060765	0.098069	0.048507	0.029452	0.071893	0.040426	0.034884	0.023197	0.067252	0.047038	0.045200	0.053124	0.065086	0.022045	0.048803	0.087895

The super-efficient portfolio is

AAPL	0.0
META	0.0
UNH	0.0
MA	0.0
MSFT	0.0
NVDA	0.0
HD	0.0
PFE	0.0
AMZN	0.0
BRK-B	6.3
PG	16.3
XOM	10.5
TSLA	0.0
JPM	0.0
V	1.3
DIS	3.2
GOOGL	0.0
JNJ	60.1
BAC	2.4
CSCO	0.0