Week 7 Report

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Problem 1

Table 1: Comparison of Greeks for Call and Put Options using Closed Form and Finite Difference Methods

Greek	**Call (Closed Form)**	**Put (Closed Form)**	**Call (Finite Difference)**	**Put (Finite Difference)**
Delta	0.0830	-0.9165	0.0830	-0.9165
Gamma	0.0168	0.0168	0.0168	0.0168
Vega	6.9387	6.9387	6.9387	6.9387
Theta	-8.1265	-1.9410	-8.1263	-1.9408
Rho	1.1026	-13.7580	-0.0304	-1.2427
Carry Rho	1.1330	-12.5153	1.1330	-12.5153

Table 2: Values of Call and Put Options Using Binomial Tree

Condition	**Call Option Value**	**Put Option Value**
Without Dividend	0.3360	14.0370
With Dividend	0.2986	14.5566

Table 3: Greeks of Call and Put Options Using Binomial Tree

Greek	**Call**	**Put**
Delta	0.0726	-0.9383
Gamma	-0.0000	0.0000
Vega	6.3194	5.6755
Theta	-7.4679	-0.4490
Rho	-0.0244	-1.1609
Carry Rho	0.9627	-11.3111

Table 4: Sensitivity to Dividend Amount for Call and Put Options

Option Type	**Call Sensitivity**	**Put Sensitivity**
Dividend Sensitivity	-0.021	0.941

Problem 2

The functions fail to compile (compile time too long)

Problem 3

Table 5: Expected Annual Returns of Stocks

Stock	**Annual Return**
AAPL	0.1571
META	0.0179
UNH	0.2538
MA	0.2229
MSFT	0.1559
NVDA	0.2797
HD	0.1206
PFE	0.0769
AMZN	-0.0429
BRK-B	0.1299
PG	0.0815
XOM	0.5218
TSLA	-0.0333
JPM	0.0983
V	0.2411
DIS	-0.1554
GOOGL	-0.0171
JNJ	0.1242
BAC	-0.1123
CSCO	0.1478

The annual covariance matrix is in the jupyter notebook (too big to display)

Table 6: Super Efficient Portfolio Weights

Stock	**Weight**
AAPL	0.00
META	0.00
UNH	22.57
MA	0.00
MSFT	0.00
NVDA	0.00
HD	0.00
PFE	0.00
AMZN	0.00
BRK-B	0.00
PG	0.00
XOM	57.44
TSLA	0.00
JPM	0.00
V	12.93
DIS	0.00
GOOGL	0.00
JNJ	7.05
BAC	0.00
CSCO	0.00

The Sharpe Ratio of the super efficient portfolio is 1.47