Week 7 Proejct

Hongbo Feng

Q1:

Here's the result of greeks calculated by BSM:

Put

```
{'value': {'option value': 13.751949648187235,
  'intrinsic value': 13.969999999999999,
  'time value': -0.21805035181276367},
 'greeks': {'delta': -0.9169889291037313,
  'gamma': 0.016830979206204362,
  'theta': -0.005520019492833374,
  'vega': 0.06942036604441162,
  'rho': -0.1376459723603804},
 'Carry Rho': 13.679464983478951}
```

Call

```
{'value': {'option value': 0.3359599437090406,
  'intrinsic value': 0,
  'time value': 0.3359599437090406},
 'greeks': {'delta': 0.08301107089626869,
  'gamma': 0.016830979206204362,
  'theta': -0.02227999433394731,
  'vega': 0.06942036604441162,
  'rho': 0.011031223810791666},
 'Carry Rho': 1.2383432356991317}
```

Here's the result of greeks calculated by infinite diff method:

```
Call  delta : 0.08297134424122277 Gamma : 0.016822917423553463 Theta : -0.09724280164056233
Put  delta : -0.9165495924605693 Gamma : 0.016822917814351968 Theta : 0.3323717247206667
```

These two sets of Greeks are very similar.

The graph below includes values of American Option value with or without dividends:

```
value of American call Option w/ div is : 0.29181370999094486
value of American put Option w/ div is : 14.627752573353897
value of American call Option w/o div is : 0.3359668460797688
value of American call Option w/o div is : 14.038608480309883
```

Q2:

The first step is using binary tree american option value function and applying solver to find the implied volatility. Then read the portfolio file, and use it to create a method to calculate each portfolio's value. Then we simulate a series of stock prices in 10 days and compute the corresponding portfolio values. Finally, calculate VaR and ES, and make a comparison between week 6' s result.

Week 6:

Portfolio	mean	VaR	ES
Call	0.114595	4.358820	4.435184
CallSpread	-0.241876	3.639153	3.715283
CoveredCall	-0.150163	9.128753	12.182153
ProtectedPut	0.239424	4.143372	4.201838
Put	0.274991	4.254978	4.334247
PutSpread	0.396478	2.674248	2.742863
Stock	-0.035568	13.487573	16.617337
Straddle	0.389586	2.443232	2.452474
SynLong	-0.160396	13.703021	16.850682

Q3:

Based on multi factor model and daily returns, we can calculate betas. Then calculate the daily return for the past 10 years. To calculate Sharpe Ratio, we need to create a Cov matrix. Then use this matrix to find an efficient portfolio curve. Finally, find the highest sharpe ratio on that curve.