

# PROJECT----WEEK07

Tina Zhao

# Problem 1

Current Stock Price \$165

Strike Price \$165

Current Date 03/13/2022

Options Expiration Date 04/15/2022

Risk Free Rate of 0.25%

Continuously Compounding Coupon of 0.53%

Implied volatility 20%

Implement the closed form greeks for GBSM.

Implement a finite difference derivative calculation.

Compare the values between the two methods for both a call and a put.

	Call(GBSM)	Call(FD_central)	Call(FD_forward)	Call(FD_backward)	Put(GBSM)	Put(FD_central)	Put(FD_forward)	Put(FD_backward)
delta	0.510071	0.510072	0.510072	0.510073	-0.489450	-0.489452	-0.489450	-0.489453
gamma	0.040173	0.040173	0.040173	0.040173	0.040173	0.040173	0.040173	0.040173
theta	21.628607	21.628606	21.628607	21.628605	22.090281	22.090282	22.090282	22.090282
vega	19.776582	19.776583	19.776583	19.776583	19.776582	19.776583	19.776584	19.776581
rho	7.253304	7.253305	7.253304	7.253306	-7.661132	-7.661133	-7.661131	-7.661134
carryrho	7.609135	7.609134	7.609133	7.609135	-7.301527	-7.301527	-7.301526	-7.301529

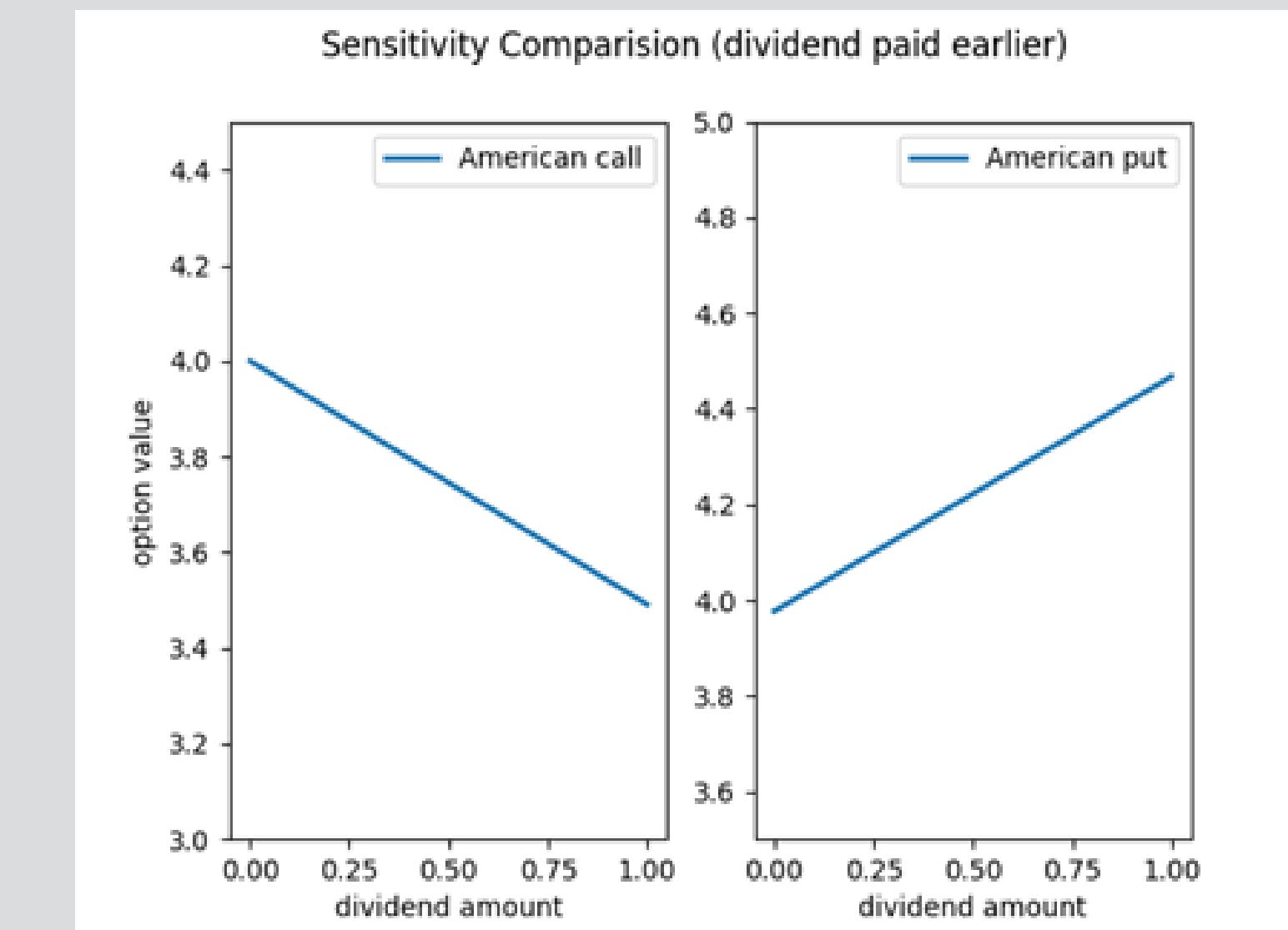
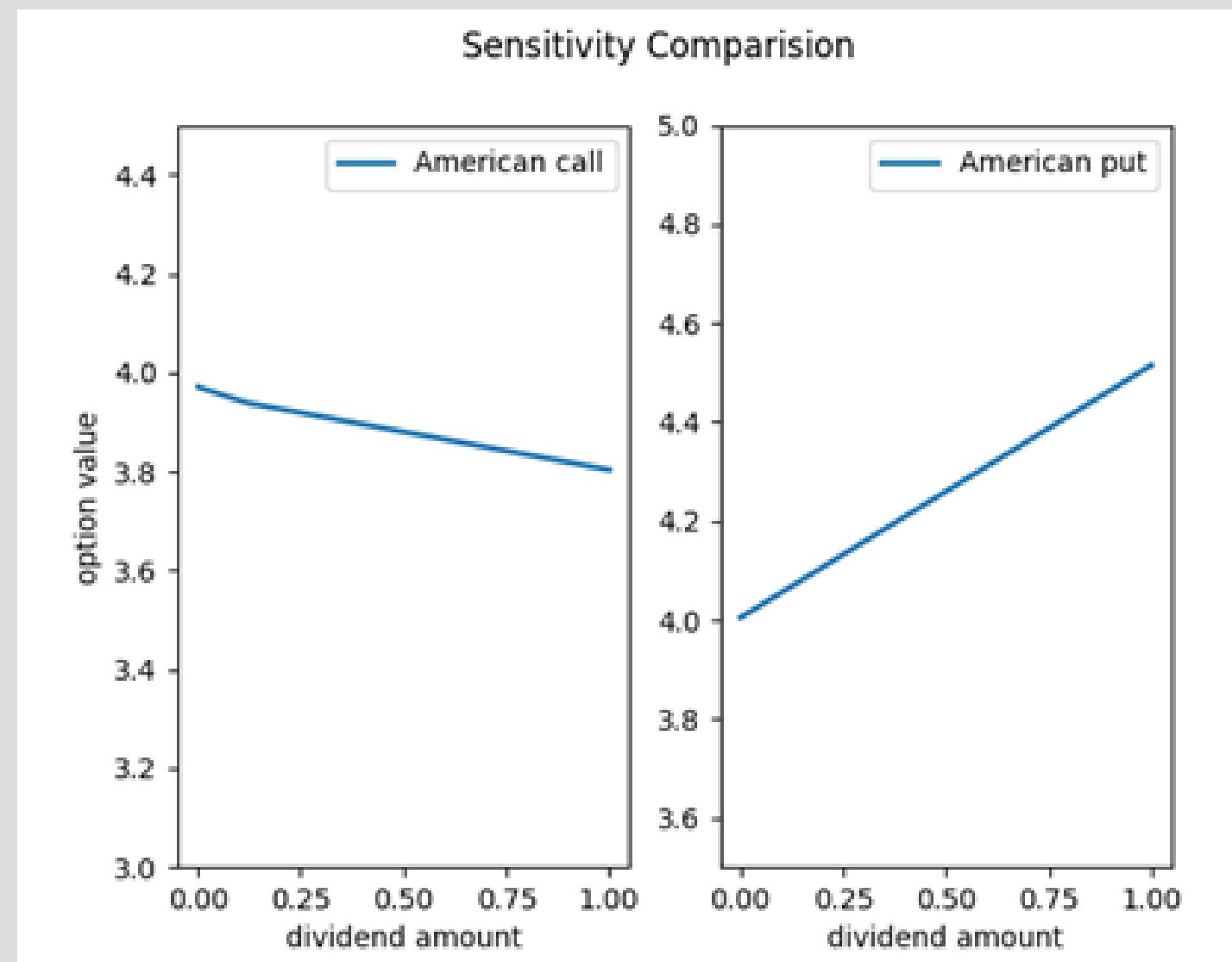
Implement the binomial tree valuation for American options with and without discrete dividends.  
Assume the stock above: Pays dividend on 4/11/2022 of \$0.88

```
Value of American call without dividend payment: 3.9683834268184377
Value of American call with dividend payment: 3.8219358100467176
Value of American put without dividend payment: 4.007520415586838
Value of American put with dividend payment: 4.45348200349653
```

Calculate the value of the call and the put. Calculate the Greeks of each.

	American Call(no dividend)	American Call(with dividend)	American Put(no dividend)	American Put(with dividend)
delta	0.510235	0.518702	-0.489372	-0.489013
gamma	-1.554312	-0.222045	1.998401	-2.442491
theta	-21.825374	-21.767844	-22.256169	-22.272059
vega	19.927488	19.852676	19.926682	19.962072
rho	6.406625	6.062072	-7.661912	-7.612112
carryrho	6.700426	6.107738	-7.299588	-6.879419

What is the sensitivity of the put and call to a change in the dividend amount



# Problem 2

Using the options portfolios from Problem3 last week (named problem2.csv in this week's repo) and assuming :

- American Options
- Current Date 02/25/2022
- Current AAPL price is 164.85
- Risk Free Rate of 0.25%
- Dividend Payment of \$1.00 on 3/15/2022

Using DailyReturn.csv. Fit a Normal distribution to AAPL returns – assume 0 mean return. Simulate AAPL returns 10 days ahead and apply those returns to the current AAPL price (above). Calculate Mean, VaR and ES.

	Mean	VaR	ES
Call	0.093070	-8.055305	-10.125321
CallSpread	-0.315476	-4.978049	-6.162531
CoveredCall	-0.242686	-7.552295	-9.409231
ProtectedPut	0.541222	-7.246904	-9.225402
Put	0.690838	-7.195558	-9.199021
PutSpread	0.642285	-3.859419	-5.003033
Stock	-0.149616	-14.402218	-18.022954
Straddle	0.783908	-5.475329	-7.065428
SynLong	-0.597768	-15.362742	-19.113642

Compare these results to last week's results.

	Mean	VaR	ES
Call	0.836915	-3.859903	-4.150611
CallSpread	0.144304	-3.158845	-3.437744
CoveredCall	-1.093139	-9.029976	-12.161225
ProtectedPut	0.885553	-3.718670	-3.967498
Put	1.141777	-3.638979	-3.915020
PutSpread	0.422362	-2.280678	-2.469182
Stock	-0.256224	-12.889879	-16.311836
Straddle	1.978691	0.009913	0.002230
SynLong	-0.304862	-13.031112	-16.494948

<--- last week's results.

	Mean	VaR	ES
Call	0.093070	-8.055305	-10.125321
CallSpread	-0.315476	-4.978049	-6.162531
CoveredCall	-0.242686	-7.552295	-9.409231
ProtectedPut	0.541222	-7.246904	-9.225402
Put	0.690838	-7.195558	-9.199021
PutSpread	0.642285	-3.859419	-5.003033
Stock	-0.149616	-14.402218	-18.022954
Straddle	0.783908	-5.475329	-7.065428
SynLong	-0.597768	-15.362742	-19.113642

# Problem 3

Use the Fama French 3 factor return time series as well as the Carhart Momentum time series to fit a 4 factor model to the following stocks.

AAPL	FB	UNH	MA
MSFT	NVDA	HD	PFE
AMZN	BRK-B	PG	XOM
TSLA	JPM	V	DIS
GOOGL	JNJ	BAC	CSCO

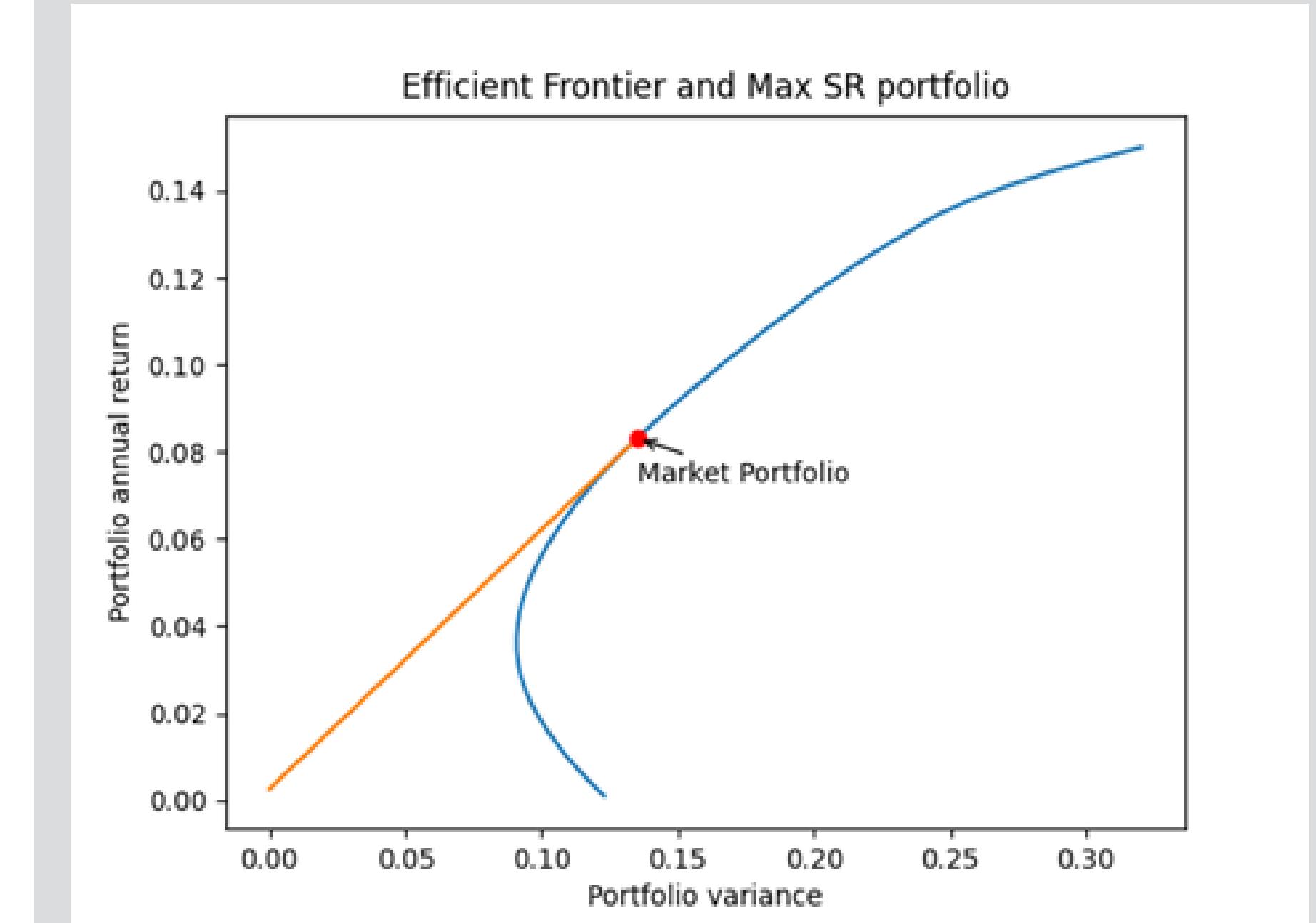
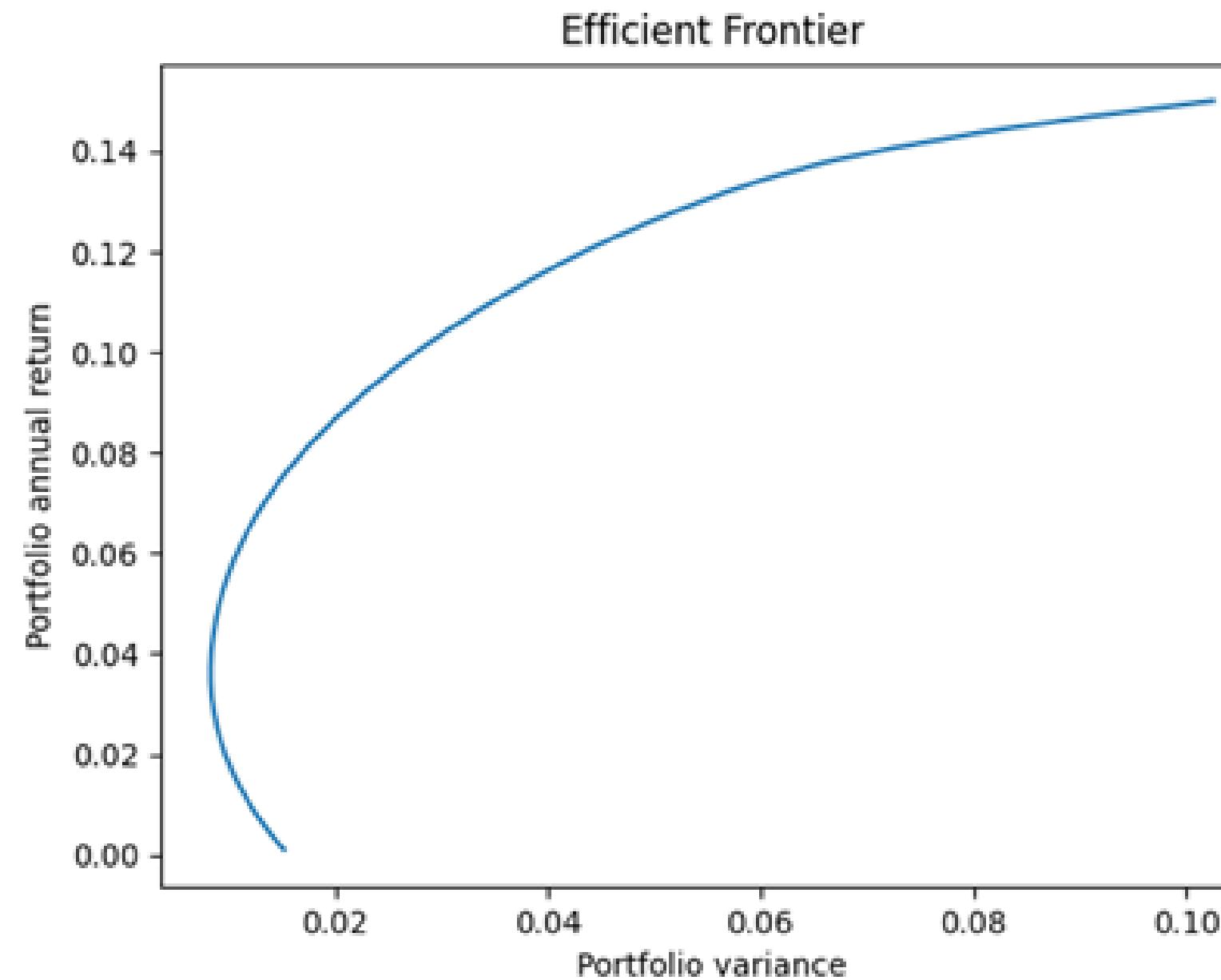


Based on the past 10 years of factor returns, find the expected annual return of each stock.

	estimated annual return by FF3 model (%)	estimated annual return by FF-M model (%)
AAPL	6.127418	7.021200
FB	10.020913	9.039345
UNH	4.504481	3.957734
MA	13.383286	10.406414
MSFT	5.999827	7.025647
NVDA	14.501962	18.252571
HD	5.135118	6.718574
PFE	-8.951634	-6.794314
AMZN	5.834868	4.459358
BRK-B	6.942455	6.329842
PG	3.431705	2.921530
XOM	12.763285	12.479405
TSLA	12.342020	16.704499
JPM	9.517161	9.375788
V	11.238276	9.955383
DIS	7.515613	5.861864
GOOGL	6.409085	6.423902
JNJ	1.805466	0.534692
BAC	12.242512	11.652437
CSCO	5.728352	5.101363

Construct an annual covariance matrix for the stocks.

Assume the risk-free rate is 0.0025. Find the super efficient portfolio



The background features a dark teal color with abstract white shapes. On the left, there are two large, semi-transparent circles: one is light blue and the other is dark navy. Both circles overlap, creating a layered effect. Overlaid on these circles are several thin, black, wavy lines that intersect and crisscross each other.

THANKS FOR LISTENING