2 Challenge

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2 Hypothesis testing - comparing the mean of 2 groups

Run a t-test to compare whether the average monthly return of AAPL is greater than the average monthly returns of MSFT

```
import matplotlib.pyplot as plt
import pandas_datareader as pdr
import numpy as np
```

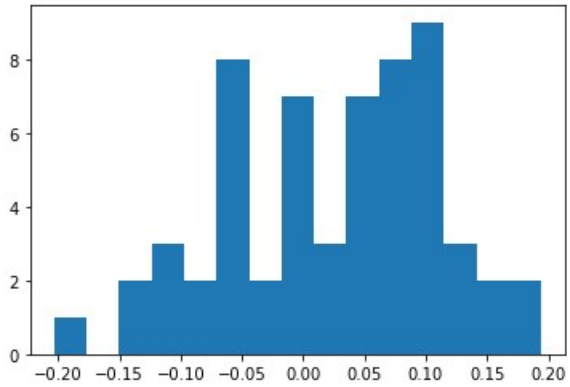
```
H0 : mean(r_AAPL) > mean(r_MSFT)  ==>  H0: mean(r_AAPL) - mean(r_MSFT) = 0
Ha: mean(r_AAPL) < mean(r_MSFT)   ==>  Ha: mean(r_AAPL) - mean(r_MSFT) != 0

VARIABLE OF STUDY = DIFFERENCE OF BOTH MEAN RETURNS
dif = mean(r_AAPL) - mean(r_MSFT)
H0: dif = 0
Ha: dif != 0
```

AAPL

```
# Collecting the real data from returns of AAPL from July 2019 until July 2022 monthly (60 months)
AAPL = pdr.get_data_yahoo("AAPL", start = "2017-07-01", end = "2022-05-31", interval = "m")
AAPL.tail()
```

Date	High	Low	Open	Close	Volume	Adj Close
2022-02-01	176.649994	152.000000	174.009995	165.119995	1.627516e+09	164.439545
2022-03-01	179.610001	150.100006	164.699997	174.610001	2.180800e+09	174.111984
2022-04-01	178.490005	155.380005	174.029999	157.649994	1.687796e+09	157.200348
2022-05-01	166.479996	132.610001	156.710007	148.839996	2.401040e+09	148.415482
2022-06-01	151.740005	129.039993	149.899994	136.720001	1.749100e+09	136.530350

```
# Calculating the monthly cc returns
AAPL["r"] = (np.log(AAPL["Adj Close"]) - np.log(AAPL["Adj Close"].shift(1)))
# Plotting the cc returns
plt.hist(AAPL['r'], bins=15)
plt.show()
```




```
# We calculate the mean of the cc returns
AAPL_mean = AAPL['r'].mean()
AAPL_mean
```

```
0.022998402961812832
```

```
# We calculate the std of the group
AAPL_std = AAPL['r'].std() / np.sqrt(AAPL["r"].count())
AAPL_std
```

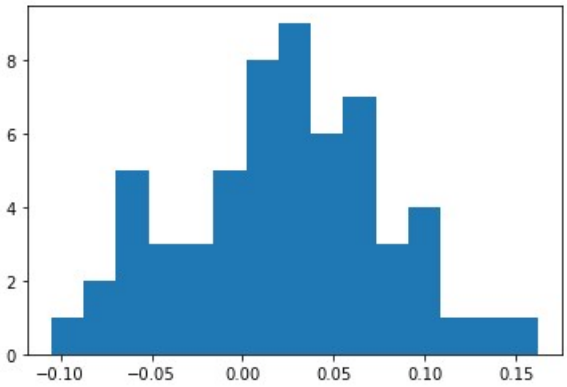
```
0.011317974045594498
```

MSFT

```
# Collecting the real data from returns of MSFT from July 2019 until July 2022 monthly
MSFT = pdr.get_data_yahoo("MSFT", start = "2017-07-01", end = "2022-05-31", interval = "m")
MSFT.tail()
```

Date	High	Low	Open	Close	Volume	Adj Close
2022-02-01	315.119995	271.519989	310.410004	298.790009	697050600.0	297.480591
2022-03-01	315.950012	270.000000	296.399994	308.309998	734334200.0	307.593567
2022-04-01	315.109985	270.000000	309.369995	277.519989	627343400.0	276.875122
2022-05-01	290.880005	246.440002	277.709991	271.869995	742902000.0	271.238251
2022-06-01	277.690002	241.509995	275.200012	256.829987	621372300.0	256.829987

```
# Calculating the monthly cc returns
MSFT["r"] = np.log(MSFT["Adj Close"]) - np.log(MSFT["Adj Close"].shift(1))
# Plotting the cc returns
plt.hist(MSFT["r"], bins = 15)
plt.show()
```



```
# Calculating the mean of the cc returns
MSFT_mean = MSFT["r"].mean()
MSFT_mean
```

```
0.02250024490874485
```

```
# Calculating the standard deviation of the cc returns
MSFT_std = MSFT["r"].std() / np.sqrt(MSFT["r"].count())
MSFT_std
```

```
0.007412906320414428
```

Calculating the t-statistic

t = ((mean(r_AAPL) - mean(r_MSFT) - 0) / se => Remember that the standard error is the standard deviation of the variable of study.

Then: t = ((mean(r_AAPL) - mean(r_MSFT) - 0) / SD(mean(r_APPL) - mean(r_MSFT)) => The standard deviation can be calculated with the squared root of the variance of this difference

Then: t = ((mean(r_AAPL) - mean(r_MSFT) - 0) / sqrt((1/N)(Var(r_AAPL) + Var(r_MSFT)))

```
# Calculating the t-statisitc
t = (AAPL_mean - MSFT_mean -0) / np.sqrt((1 / MSFT["r"].count()) * (AAPL_std**2 + MSFT_std**2))
t
```

```
0.28282057658575654
```

SINCE THE RESULT OF THE T-STATISTIC IS THAT THE DIFFERENCE BETWEEN THE TOW MEANS IS 0.28 STANDARD DEVIATIONS, WE CANNOT DETERMINE THAT NEITHER OF THE HYPOTHESIS ARE CONFIRMED.