In [1]:

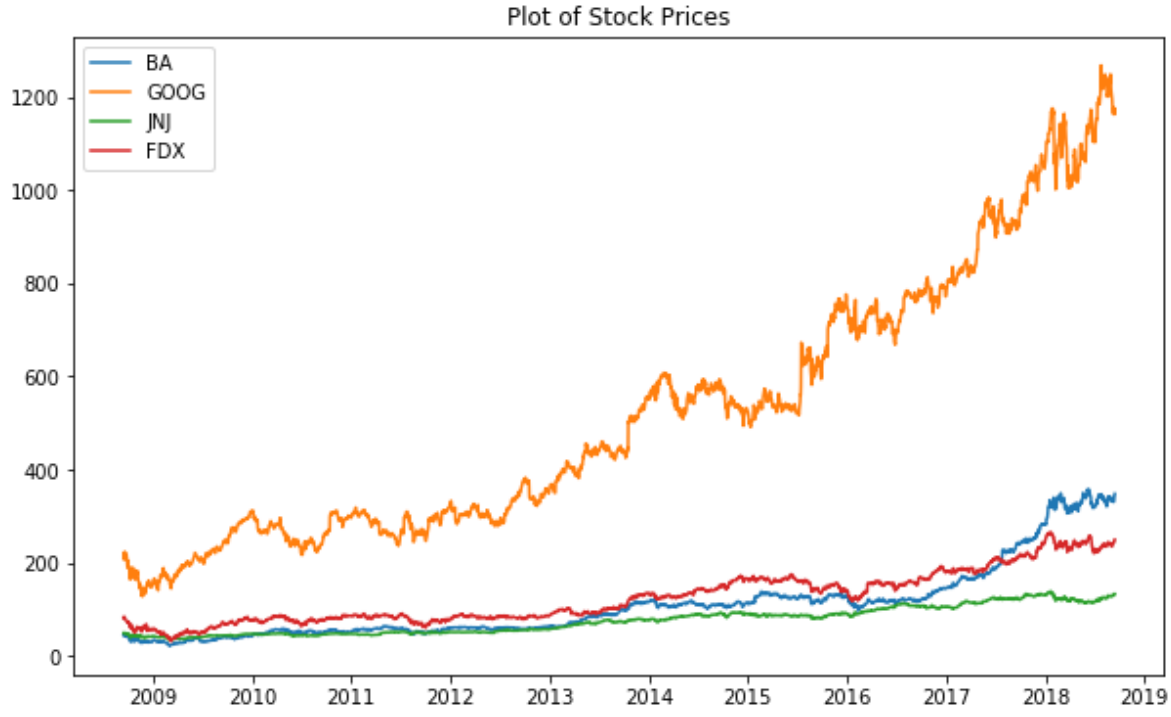
```
import numpy as np
import pandas as pd
import seaborn as sb
import matplotlib.pyplot as plt
%matplotlib inline
```

In [17]:

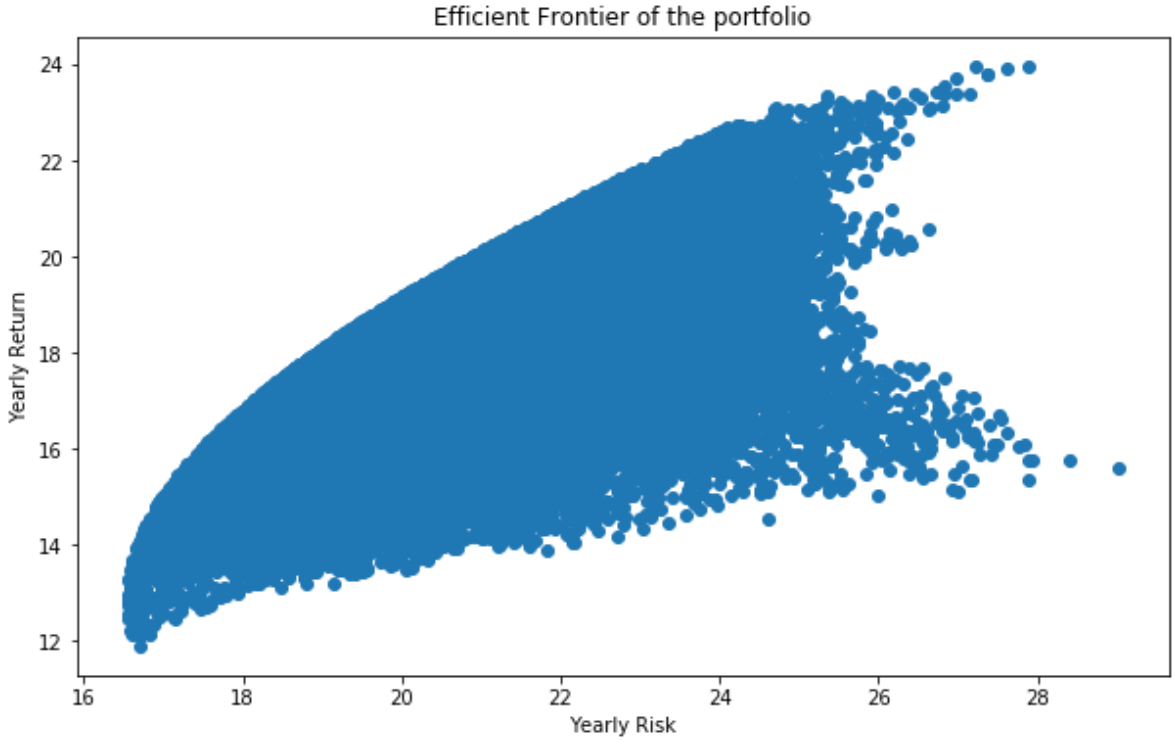
```
#Portfolio Optimization
#Getting and munging our data
import yfinance as yf
start = input("Please enter the start date in yyyy-mm-dd format: ")
end = input("Please enter the end date in yyyy-mm-dd format: ")
a = int(input("How many stocks do you want?: "))
l = []
i = 0
w = []
while i < a:
    s = input("Please enter the stock symbol: ")
    print(f"Weight remaining: {1 -sum(w)}")
    w.append(float(input("Enter its weight in your portfolio")))
    l.append(s)
    i = i+1
print(l)
stockdata = pd.DataFrame()
stockdataret = pd.DataFrame()
stockdataavgret = []
t = 0
while t < a:
    s = yf.download(l[t],start=start,end=end).iloc[:,4]
    stockdata[l[t]] = s
    stockdataret[l[t] + ' Change'] = ((stockdata[l[t]] - stockdata[l[t]].shift(1))/stockdat
    t = t+1
plt.figure(figsize=(10,6))
plt.title("Plot of Stock Prices")
c=0
while c<a:
    plt.plot(stockdata.iloc[:,c],label=l[c])
    plt.legend()
    c = c+1
plt.show()
m = 0
while m<a:
    stockdataavgret.append(stockdataret.iloc[1:,m].mean())
    m = m+1
stockdataavgret = np.reshape(stockdataavgret,(a,1))
w = np.reshape(w,(a,1))
covarmtrx = stockdataret.cov()
portvar = (np.dot(np.dot(w.T,covarmtrx),w))[0,0]
portrisk = (portvar**0.5)*100
avgret = (np.dot(w.T,stockdataavgret))[0,0]
c = 0
print(f'The portfolio average yearly return is {(avgret*100)*(252)}% & the average yearly r
rsk = []
ret = []
wt = []
shrpe = []
g = 0
while g < 100000:
    rw =np.random.rand(a)
    rw = rw/(np.sum(rw))
    wt.append(rw)
    rw = np.reshape(rw,(a,1))
    variance = (np.dot(np.dot(rw.T,covarmtrx),rw))[0,0]
    risk = (variance**0.5)*100
    rsk.append((risk)*(252**0.5))
    retrn = ((np.dot(rw.T,stockdataavgret)[0,0])*100)*252
```

```
    ret.append(retrn)
    shrpe.append((((retrn/252)-0.025))/(risk/(252**0.5)))  #Sharpe Ratio
    g = g+1
Eff = pd.DataFrame()
Eff['rsk'] = rsk
Eff['ret'] = ret
plt.figure(figsize=(10,6))
plt.title("Efficient Frontier of the portfolio")
plt.scatter(rsk,ret)
plt.xlabel("Yearly Risk")
plt.ylabel("Yearly Return")
plt.show()
g = shrpe.index(max(shrpe))
print("The optimal weights of the portfolio are:")
print(l)
print(f"{wt[g]*100}%")
print(f"The yearly average return of the optimised portfolio is {ret[g]}% & risk is {(rsk[g
print(f"The maximum sharpe ratio is {shrpe[g]}")
```

```
Please enter the start date in yyyy-mm-dd format: 2008-09-15
Please enter the end date in yyyy-mm-dd format: 2018-09-16
How many stocks do you want?: 4
Please enter the stock symbol: BA
Weight remaining: 1
Enter its weight in your portfolio0.25
Please enter the stock symbol: GOOG
Weight remaining: 0.75
Enter its weight in your portfolio0.25
Please enter the stock symbol: JNJ
Weight remaining: 0.5
Enter its weight in your portfolio0.25
Please enter the stock symbol: FDX
Weight remaining: 0.25
Enter its weight in your portfolio0.25
['BA', 'GOOG', 'JNJ', 'FDX']
[**********100%**********]  1 of 1 completed
[**********100%**********]  1 of 1 completed
[**********100%**********]  1 of 1 completed
[**********100%**********]  1 of 1 completed
```



```
The portfolio average yearly return is 17.966865048931815% & the average yea
rly risk is 20.203655701979223%
```




```
The optimal weights of the portfolio are:
['BA', 'GOOG', 'JNJ', 'FDX']
[60.08683417 37.98376913  1.77390741  0.15548929]%
The yearly average return of the optimised portfolio is 22.684847954348665%
& risk is 24.08429104899235%
The maximum sharpe ratio is 0.6803126536304746
```

In [ ]: