In [2]:
```
import pandas as Pd
from pandas import Series, DataFrame
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
%matplotlib inline
```

In [5]:
```
#pip install pandas-datareader
```

In [6]:
```
#from pandas.io.data import DataReader
from pandas_datareader import data, wb
from datetime import datetime
#from __future__ import division
```

In [7]:
```
tech_list=['AAPL', 'GOOG', 'MSFT', 'AMZN']
end= datetime.now()
start=datetime(end.year-1, end.month, end.day)
for stock in tech_list:     #grabing Yahoo data and setting as a Data frame
    globals()[stock]= data.DataReader(stock, 'yahoo', start, end)
```

In [8]:
```
AMZN.head()
```

Out[8]:

Date	High	Low	Open	Close	Volume	Adj Close
2019-01-29	1632.380005	1590.719971	1631.270020	1593.880005	4632800	1593.880005
2019-01-30	1676.949951	1619.680054	1623.000000	1670.430054	5783800	1670.430054
2019-01-31	1736.410034	1679.079956	1692.849976	1718.729980	10910300	1718.729980
2019-02-01	1673.060059	1622.010010	1638.880005	1626.229980	11506200	1626.229980
2019-02-04	1649.630005	1613.500000	1623.000000	1633.310059	4929100	1633.310059

In [9]:
```
GOOG.head()
```

Out[9]:

Date	High	Low	Open	Close	Volume	Adj Close
2019-01-29	1075.150024	1055.864990	1072.680054	1060.619995	1021800	1060.619995
2019-01-30	1091.000000	1066.849976	1068.430054	1089.060059	1279800	1089.060059
2019-01-31	1117.329956	1095.410034	1103.000000	1116.369995	1538300	1116.369995
2019-02-01	1125.000000	1104.890015	1112.400024	1110.750000	1462200	1110.750000
2019-02-04	1132.800049	1109.020020	1112.660034	1132.800049	2576500	1132.800049

In [10]:
```
AAPL.head()
```

Out[10]:

Date	High	Low	Open	Close	Volume	Adj Close
2019-01-29	158.130005	154.110001	156.250000	154.679993	41587200.0	152.390320
2019-01-30	166.149994	160.229996	163.250000	165.250000	61109800.0	162.803864
2019-01-31	169.000000	164.559998	166.110001	166.440002	40739600.0	163.976242
2019-02-01	168.979996	165.929993	166.960007	166.520004	32668100.0	164.055069
2019-02-04	171.660004	167.279999	167.410004	171.250000	31495500.0	168.715042

In [11]:
```
MSFT.head()
```

Out[11]:

Date	High	Low	Open	Close	Volume	Adj Close
2019-01-29	104.970001	102.169998	104.879997	102.940002	31490500.0	101.440102
2019-01-30	106.379997	104.330002	104.620003	106.379997	49471900.0	104.829979
2019-01-31	105.220001	103.180000	103.800003	104.430000	55636400.0	102.908394
2019-02-01	104.099998	102.349998	103.779999	102.779999	35535700.0	101.282433
2019-02-04	105.800003	102.769997	102.870003	105.739998	31315100.0	104.199295

In [12]:
```
AAPL.describe()
```

Out[12]:

	High	Low	Open	Close	Volume	Adj Close
count	253.000000	253.000000	253.000000	253.000000	2.530000e+02	253.000000
mean	221.576126	217.892767	219.509723	219.954743	2.771441e+07	218.881180
std	40.449885	40.071015	40.170771	40.491673	9.766479e+06	41.136634
min	158.130005	154.110001	156.250000	154.679993	1.136200e+07	152.390320
25%	194.960007	190.779999	191.660004	192.740005	2.099050e+07	191.435730
50%	207.419998	203.839996	205.789993	205.699997	2.588620e+07	204.968811
75%	246.729996	241.809998	244.759995	243.580002	3.204650e+07	242.850891
max	327.799988	321.380005	324.450012	326.649994	6.928140e+07	326.649994

In [13]:
```
AAPL.info()
```

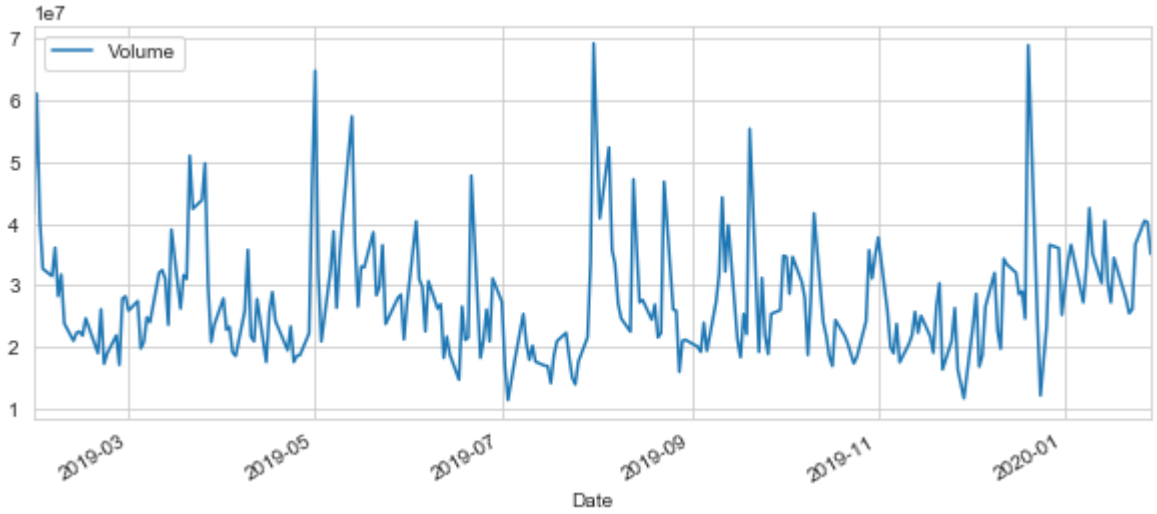
```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 253 entries, 2019-01-29 to 2020-01-29
Data columns (total 6 columns):
High         253 non-null float64
Low          253 non-null float64
Open         253 non-null float64
Close        253 non-null float64
Volume       253 non-null float64
Adj Close    253 non-null float64
dtypes: float64(6)
memory usage: 13.8 KB
```

In [14]:
```
AAPL['Adj Close'].plot(legend=True, figsize=(10,4))
```

Out[14]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ed885dd30>
```

In [15]:
```
AAPL['Volume'].plot(legend=True, figsize=(10,4))
```

Out[15]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ed89ac518>
```



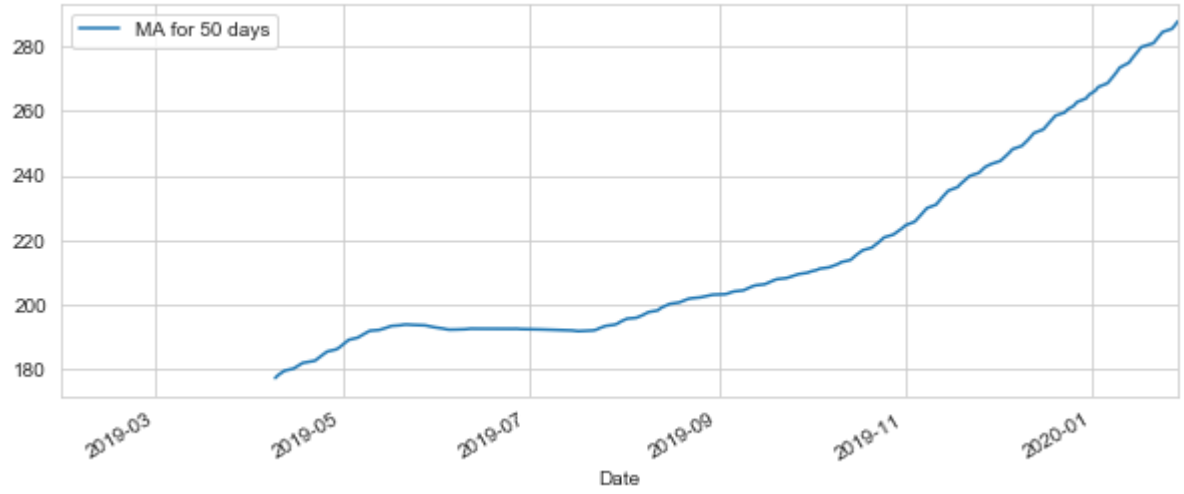
In [16]:
```
#moving average calculations for various intervals
ma_day=[10,20,50]
for ma in ma_day:
    column_name="MA for %s days" % (str(ma))
#AAPL[Column_name]=Pd.rolling_mean(AAPL['Adj Close'], ma)
    AAPL[column_name]=Pd.Series(AAPL['Adj Close']).rolling(window=ma).mean() #pd.
```

In [17]:
```
AAPL[column_name]
```

Out[17]:
```
Date
2019-01-29           NaN
2019-01-30           NaN
2019-01-31           NaN
2019-02-01           NaN
2019-02-04           NaN
                    ...
2020-01-23    283.155200
2020-01-24    284.277399
2020-01-27    285.217200
2020-01-28    286.281600
2020-01-29    287.561799
Name: MA for 50 days, Length: 253, dtype: float64
```

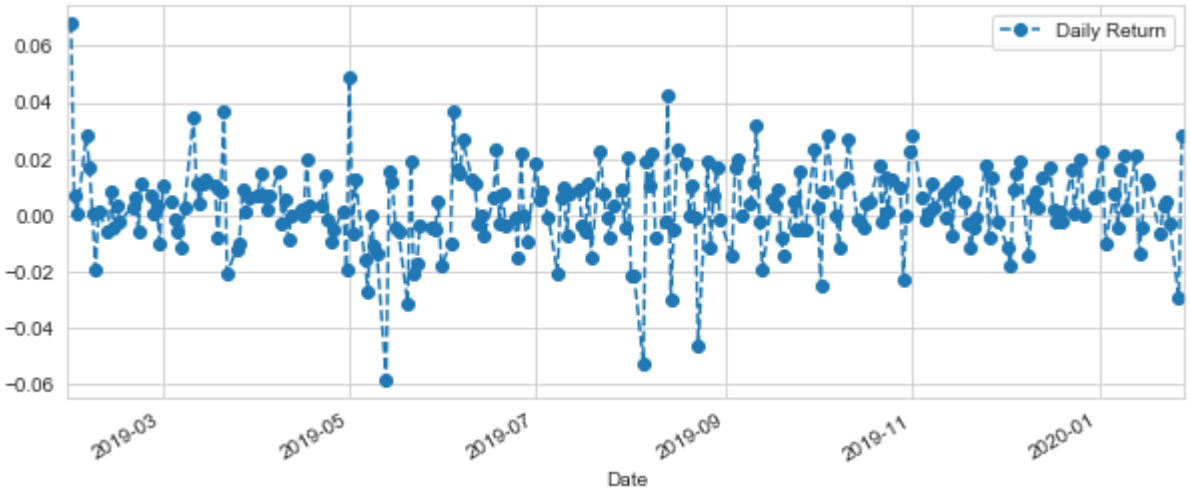
In [18]:
```
#AAPL['Adj Close'].plot(legend=True, figsize=(10,4))
AAPL[column_name].plot(subplots=False,legend=True, figsize=(10,4))
```

Out[18]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ed88b9dd8>
```



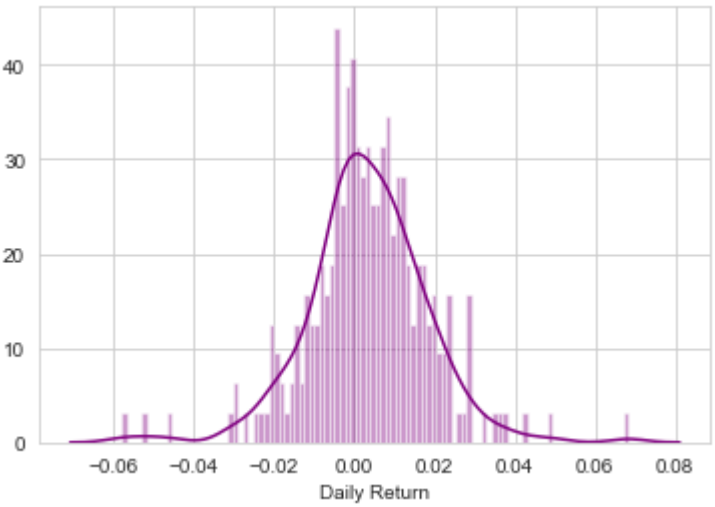
In [19]:
```
#Daily returns
AAPL['Daily Return']=AAPL['Adj Close'].pct_change()
AAPL['Daily Return'].plot(figsize=(10,4), legend=True, linestyle='--', marker='o'
```

Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x24ed8d6d550>



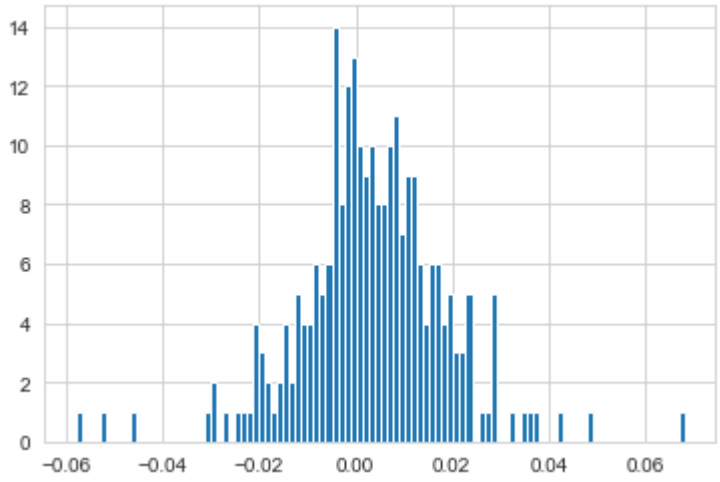
In [20]:
```
sns.distplot(AAPL['Daily Return'].dropna(), bins=100, color='purple')
```

Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x24ed8dcb7f0>



In [21]:
```
#using pandas histogram
AAPL['Daily Return'].hist(bins=100)
```

Out[21]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ed8e63828>
```



In [22]:
```
Closing_df=data.DataReader(tech_list, 'yahoo', start, end)['Adj Close']
Closing_df.head()
```

Out[22]:

Symbols	AAPL	GOOG	MSFT	AMZN
Date				
2019-01-29	152.390320	1060.619995	101.440102	1593.880005
2019-01-30	162.803864	1089.060059	104.829979	1670.430054
2019-01-31	163.976242	1116.369995	102.908394	1718.729980
2019-02-01	164.055069	1110.750000	101.282433	1626.229980
2019-02-04	168.715042	1132.800049	104.199295	1633.310059

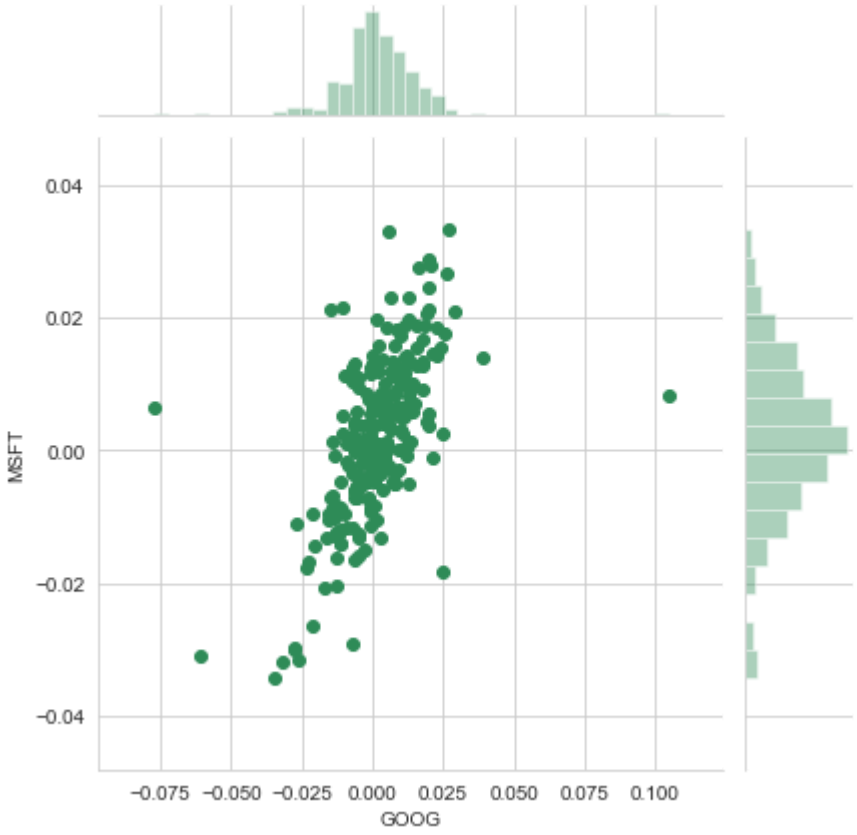
In [23]:
```
tech_rets=Closing_df.pct_change()# percent change
tech_rets.head()
```

Out[23]:

Symbols	AAPL	GOOG	MSFT	AMZN
Date				
2019-01-29	NaN	NaN	NaN	NaN
2019-01-30	0.068335	0.026815	0.033418	0.048027
2019-01-31	0.007201	0.025077	-0.018330	0.028915
2019-02-01	0.000481	-0.005034	-0.015800	-0.053819
2019-02-04	0.028405	0.019851	0.028799	0.004354

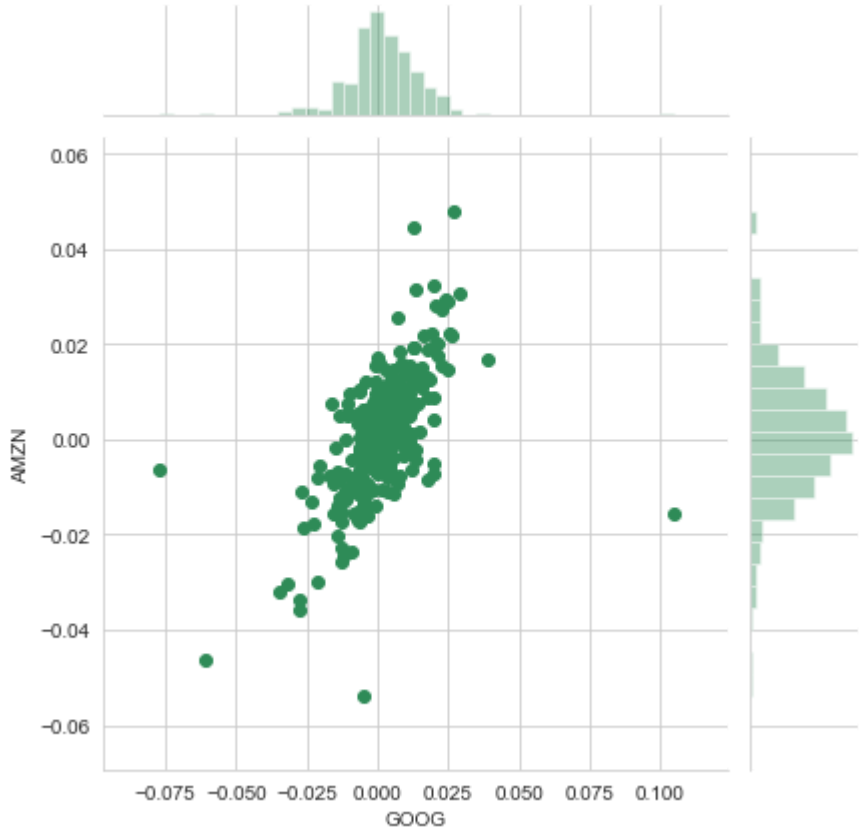
In [24]:
```
sns.jointplot('GOOG','MSFT', tech_rets, kind='scatter', color='seagreen')
```

Out[24]:
```
<seaborn.axisgrid.JointGrid at 0x24ed91d1630>
```



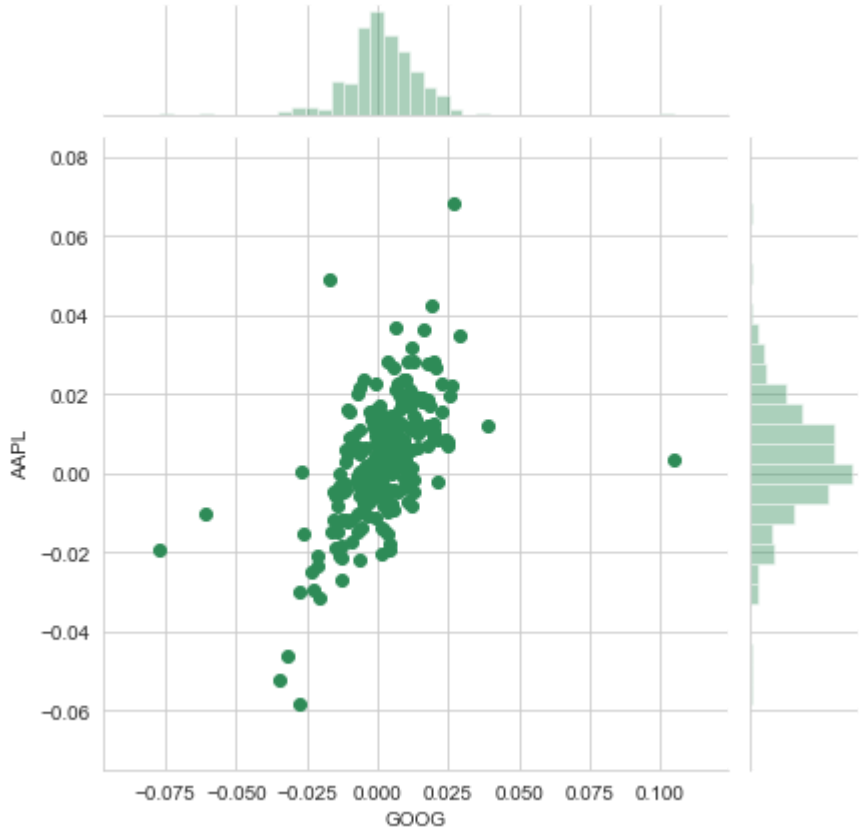
In [25]:
```
sns.jointplot('GOOG','AMZN', tech_rets, kind='scatter', color='seagreen')
```

Out[25]:
```
<seaborn.axisgrid.JointGrid at 0x24ed9207320>
```



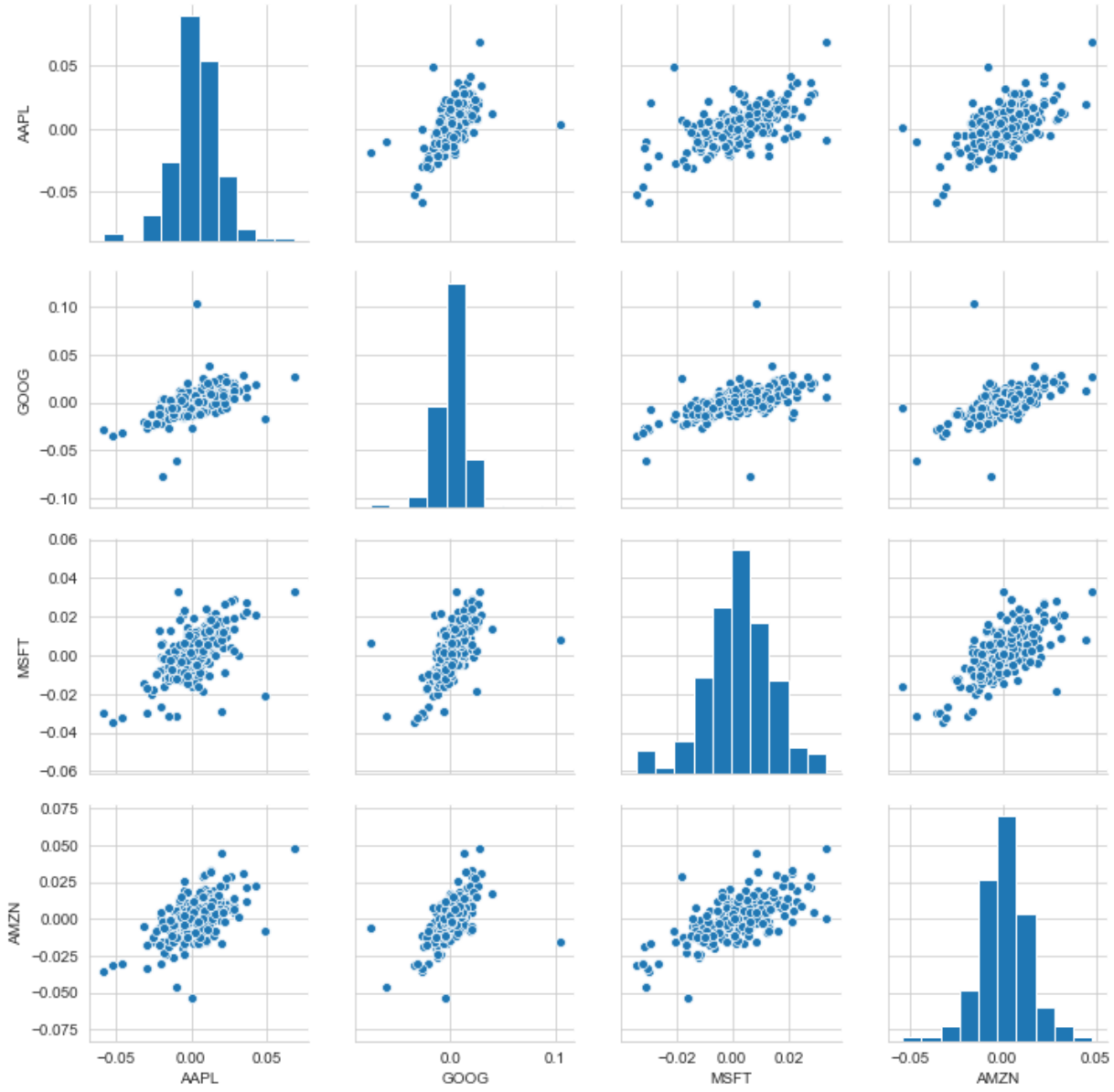
In [26]:
```
sns.jointplot('GOOG','AAPL', tech_rets, kind='scatter', color='seagreen')
```

Out[26]:
```
<seaborn.axisgrid.JointGrid at 0x24ed939f630>
```



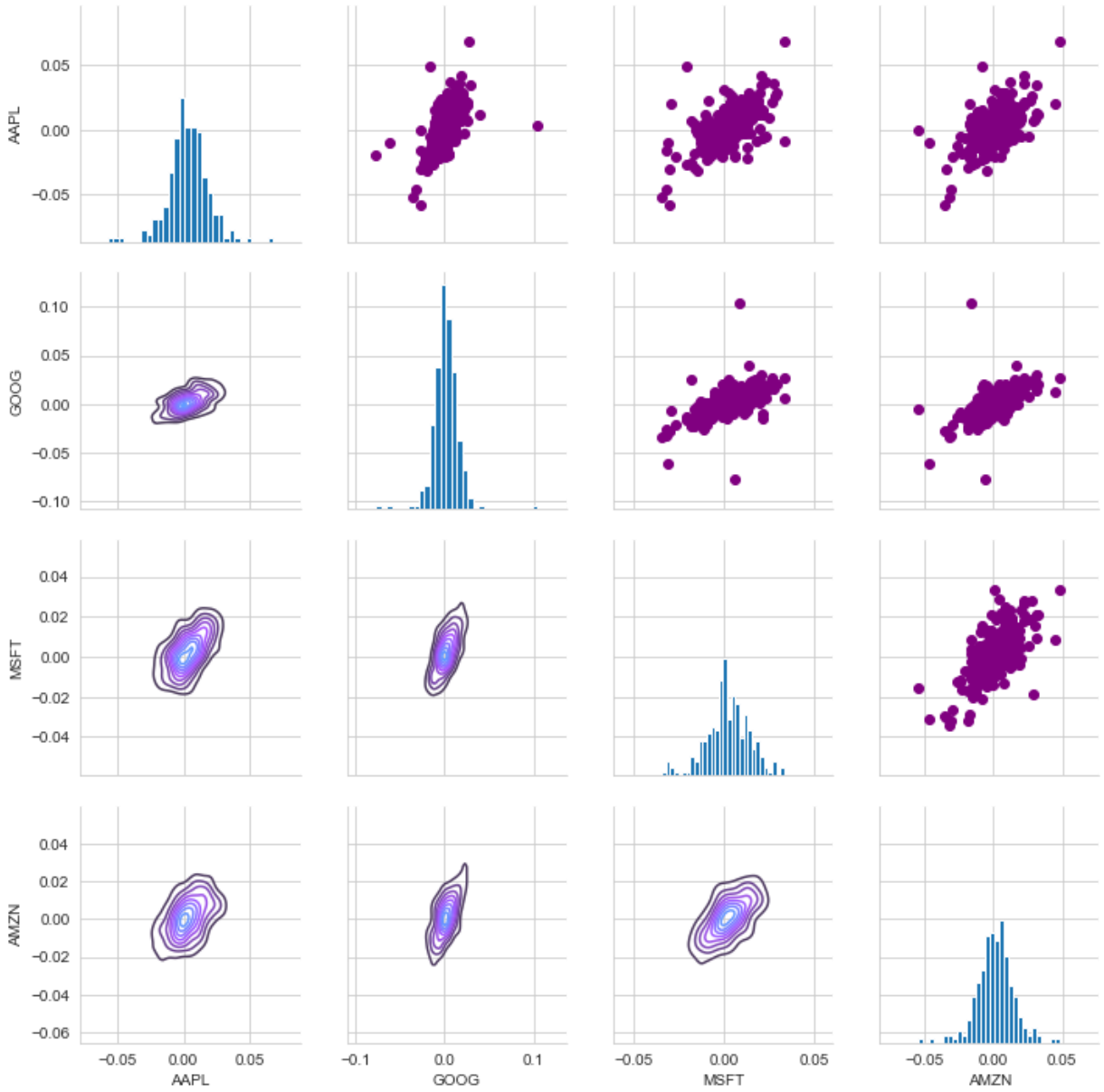
In [27]:
```
# use sns and pd for comparison
sns.pairplot(tech_rets.dropna())
```

Out[27]: <seaborn.axisgrid.PairGrid at 0x24ed93ea6d8>



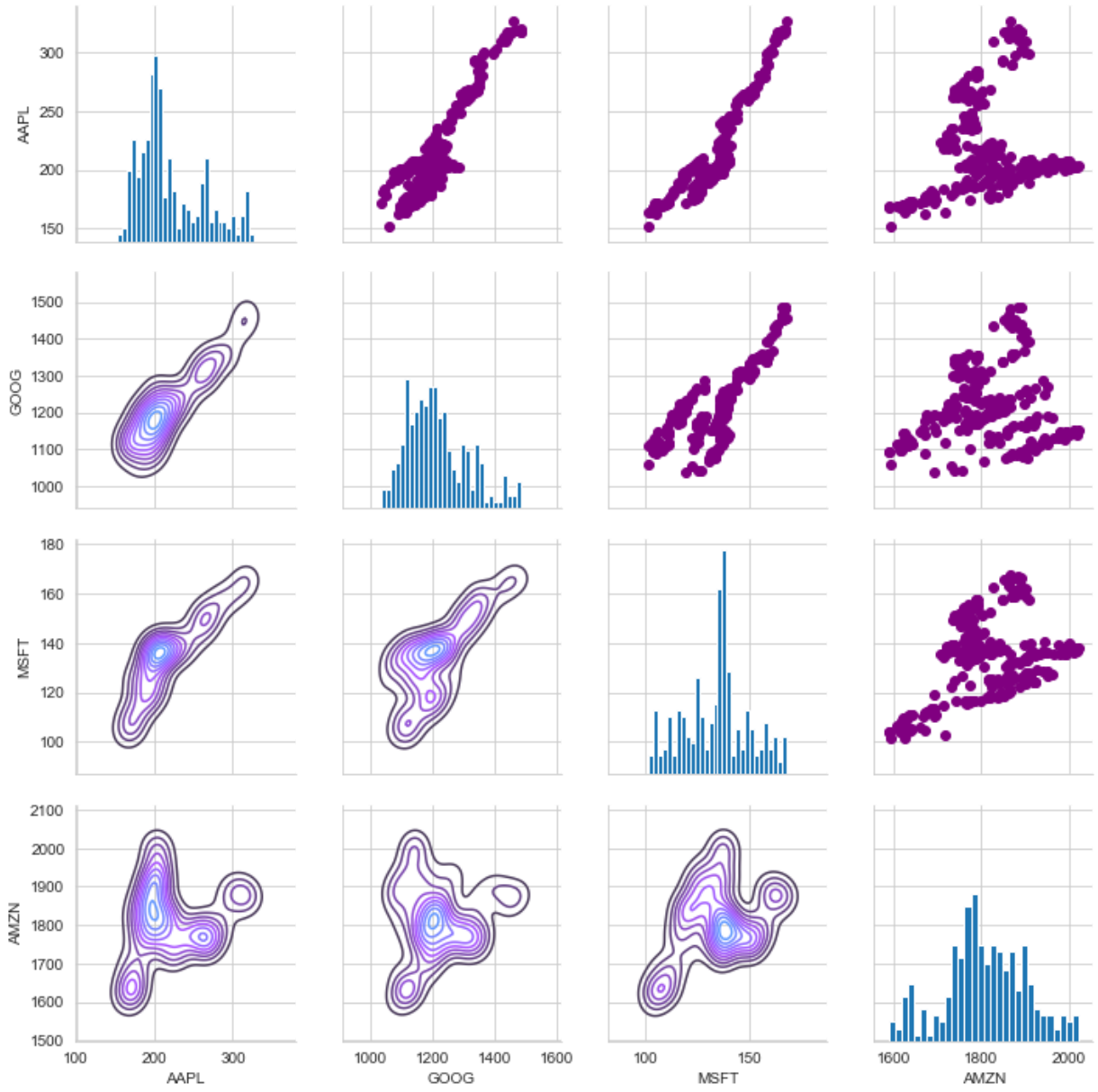
In [28]:
```
returns_fig=sns.PairGrid(tech_rets.dropna())
returns_fig.map_upper(plt.scatter, color='purple')
returns_fig.map_lower(sns.kdeplot, cmap='cool_d')
returns_fig.map_diag(plt.hist, bins=30)
```

Out[28]: <seaborn.axisgrid.PairGrid at 0x24edadf3c50>



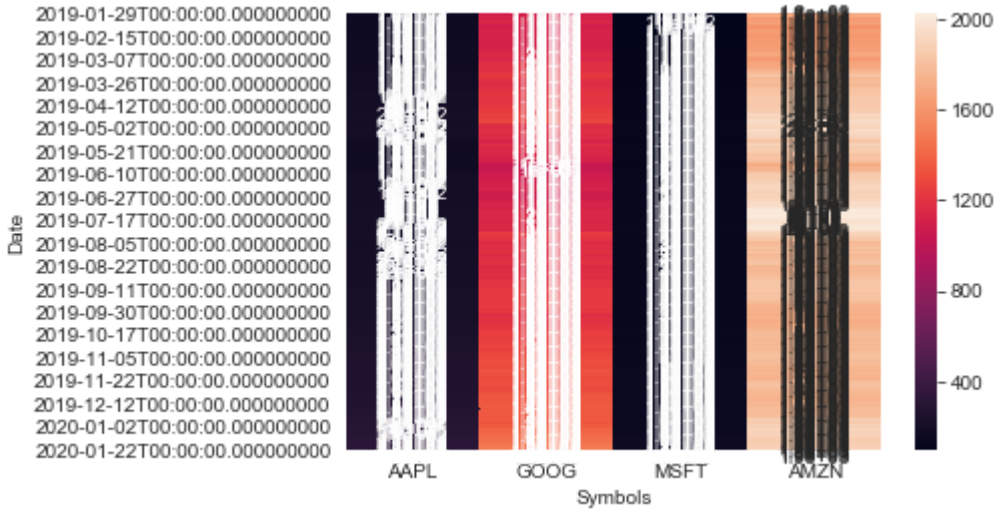
In [29]:
```
returns_fig=sns.PairGrid(Closing_df.dropna())
returns_fig.map_upper(plt.scatter, color='purple')
returns_fig.map_lower(sns.kdeplot, cmap='cool_d')
returns_fig.map_diag(plt.hist, bins=30)
```

Out[29]: <seaborn.axisgrid.PairGrid at 0x24edba23f60>



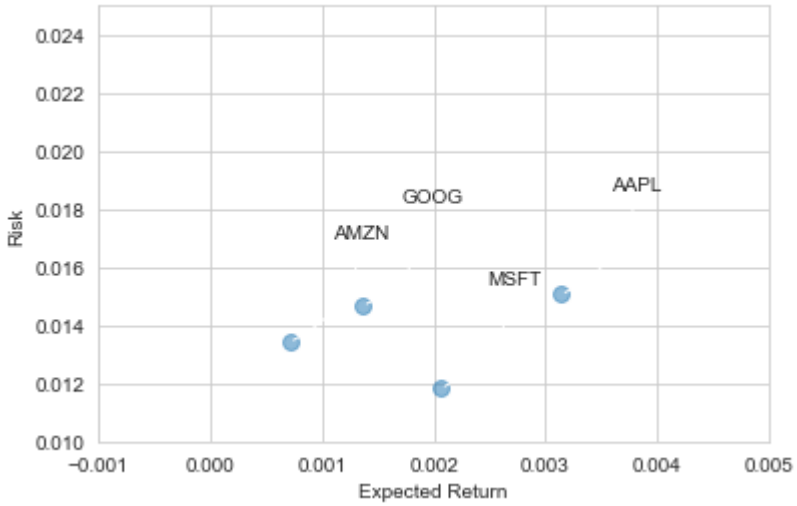
In [36]:
```
#sns.corrplot(tech_rets.dropna(), annot=True)
#sns.corrplot(Closing_df.dropna(), annot=True)
#sns.heatmap(tech_rets.dropna(), annot=True)
sns.heatmap(Closing_df.dropna(), annot=True)
```

Out[36]: <matplotlib.axes._subplots.AxesSubplot at 0x24edefcd4e0>



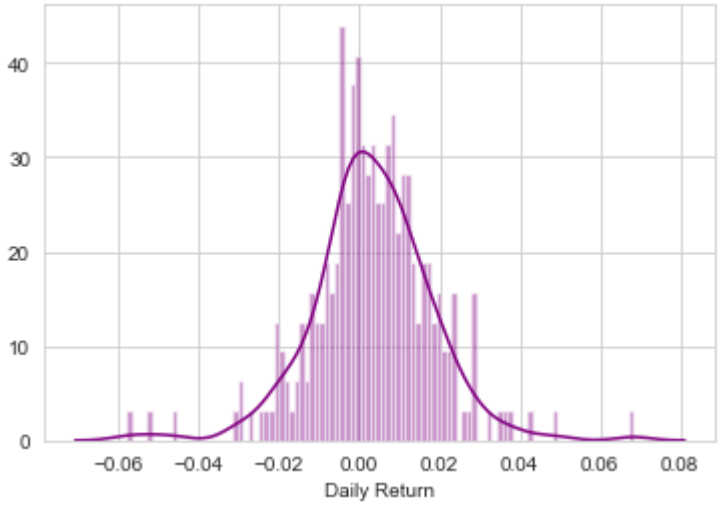
In [37]:
```
#from seaborn.linearmodels import corrplot,symmatplot
```

In [57]:
```
#Risk Analysis> standard deviation of daily returns
rets=tech_rets.dropna()
area=np.pi*20
plt.scatter(rets.mean(),  rets.std(), alpha=0.5,s=area)
plt.ylim([0.01, 0.025])
plt.xlim([-0.001,0.005])
plt.xlabel('Expected Return')
plt.ylabel('Risk')
for label, x,y in zip(rets.columns, rets.mean(), rets.std()):
    plt.annotate(
        label,
        xy=(x,y), xytext=(50,50),
    textcoords='offset points', ha='right', va='bottom',
    arrowprops=dict(arrowstyle='-',  connectionstyle='arc3, rad=-0.3'))
```



In [63]:
```
sns.distplot(AAPL['Daily Return'].dropna(), bins=100, color='purple')
```

Out[63]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ee0fb4400>
```



In [59]:
```
rets.head()
```

Out[59]:

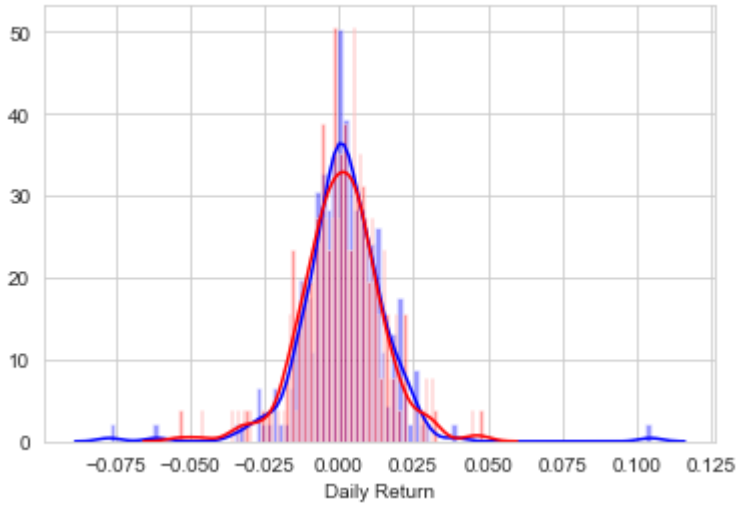
Symbols	AAPL	GOOG	MSFT	AMZN
Date				
2019-01-30	0.068335	0.026815	0.033418	0.048027
2019-01-31	0.007201	0.025077	-0.018330	0.028915
2019-02-01	0.000481	-0.005034	-0.015800	-0.053819
2019-02-04	0.028405	0.019851	0.028799	0.004354
2019-02-05	0.017110	0.011644	0.013997	0.015612

In [69]:
```
rets['AAPL'].quantile(0.05)
```

Out[69]:
```
-0.020535694375501234
```

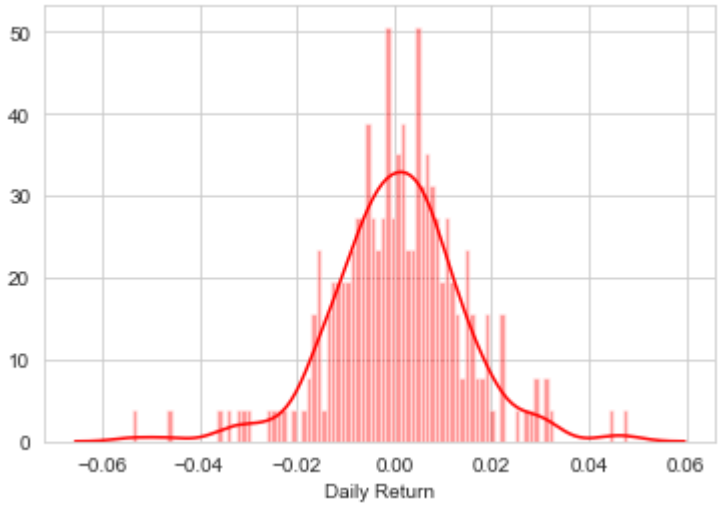
In [75]:
```
GOOG['Daily Return']=GOOG['Adj Close'].pct_change()
sns.distplot(GOOG['Daily Return'].dropna(), bins=100, color='blue')

AMZN['Daily Return']=AMZN['Adj Close'].pct_change()
sns.distplot(AMZN['Daily Return'].dropna(), bins=100, color='red')
```

Out[75]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ee1aed860>
```



In [74]:
```
AMZN['Daily Return']=AMZN['Adj Close'].pct_change()
sns.distplot(AMZN['Daily Return'].dropna(), bins=100, color='red')
```

Out[74]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24ee1995eb8>
```



In [77]:
```
#Monte Carlo Risk Analysis
mu=rets.mean()['GOOG'] # average daily returns
sigma=rets.std()['GOOG'] # standard deviation
```

In [84]:
```
days=365
dt=1/days
def stock_monte_carlo(start_price, days, mu, sigma):
    price=np.zeros(days)
    price[0]=start_price
    shock=np.zeros(days)
    drift=np.zeros(days)
    for x in range(1, days):
        shock[x]=np.random.normal(loc=mu*dt, scale=sigma*np.sqrt(dt))
        drift[x]=mu*dt
        price[x]=price[x-1]+(price [x-1]*(drift[x]+shock[x]))
    return price
```

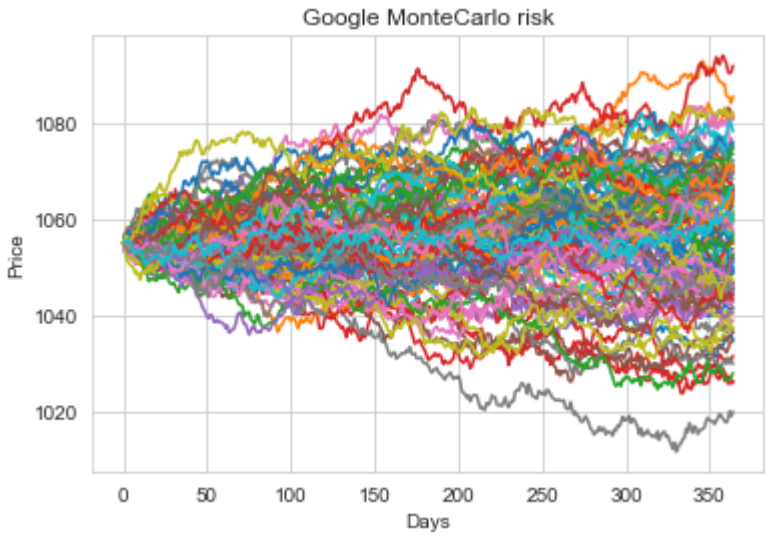
In [85]:
```
GOOG.head()
```

Out[85]:

Date	High	Low	Open	Close	Volume	Adj Close	Daily Return
2019-01-29	1075.150024	1055.864990	1072.680054	1060.619995	1021800	1060.619995	NaN
2019-01-30	1091.000000	1066.849976	1068.430054	1089.060059	1279800	1089.060059	0.026815
2019-01-31	1117.329956	1095.410034	1103.000000	1116.369995	1538300	1116.369995	0.025077
2019-02-01	1125.000000	1104.890015	1112.400024	1110.750000	1462200	1110.750000	-0.005034
2019-02-04	1132.800049	1109.020020	1112.660034	1132.800049	2576500	1132.800049	0.019851

In [86]:
```
start_price=1055
for run in range(100):
    plt.plot(stock_monte_carlo(start_price, days, mu, sigma))
plt.xlabel('Days')
plt.ylabel('Price')
plt.title('Google MonteCarlo risk')
```

Out[86]:
```
Text(0.5, 1.0, 'Google MonteCarlo risk')
```



In [89]:
```
runs=10000
simulations=np.zeros(runs)
for run in range(runs):
    simulations[run]=stock_monte_carlo(start_price, days, mu, sigma)[days-1]
```

In [90]:
```
simulations[run]
```

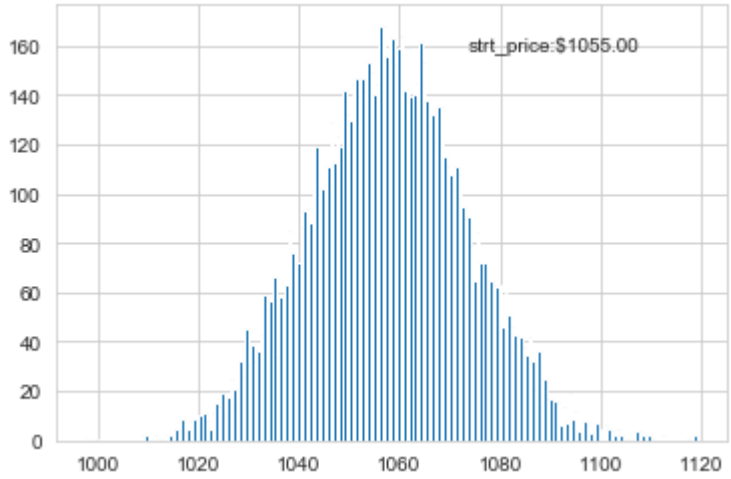
Out[90]:
```
1079.5136004015258
```

In [91]:
```
simulations
```

Out[91]:
```
array([1082.36967274, 1078.16303707, 1083.93167246, ..., 1031.06170091,
       1045.92096494, 1079.5136004 ])
```

In [92]:
```
q=np.percentile(simulations, 1)
plt.hist(simulations, bins=200)
plt.figtext(0.6,0.8, s="strt_price:$%.2f"%start_price)
```

Out[92]:
```
Text(0.6, 0.8, 'strt_price:$1055.00')
```



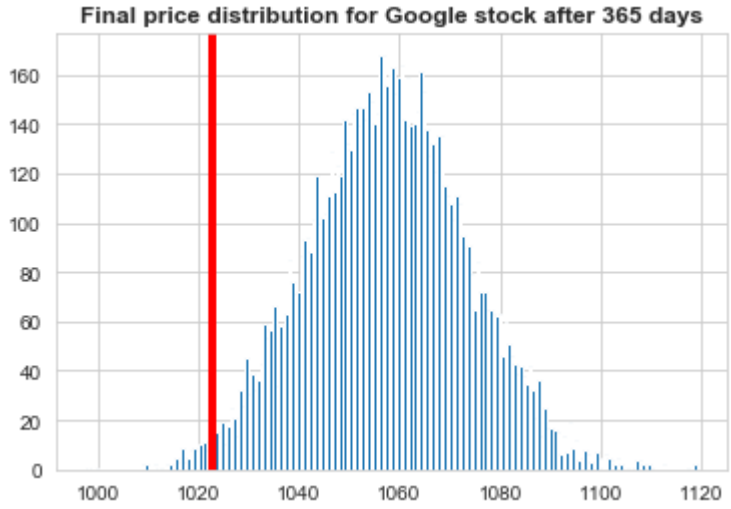
In [94]:
```
plt.figtext(0.6,0.6, "VaR(0.99):$%.2f"%(start_price-q,)) # variance within 99% cc
plt.figtext(0.15,0.6, "q(0.99):$%.2f"%q) # 1% quantile
```

Out[94]:
```
Text(0.15, 0.6, 'q(0.99):$1022.84')
```

```
<Figure size 432x288 with 0 Axes>
```

In [97]:
```
plt.hist(simulations, bins=200)
plt.axvline(x=q, linewidth=4, color='r')
plt.title(u"Final price distribution for Google stock after %s days" %days, weigh
```

Out[97]:
```
Text(0.5, 1.0, 'Final price distribution for Google stock after 365 days')
```



In [ ]: