Airlines_Portfolio

September 29, 2021

1 Airlines Portfolio Risk and Returns

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import math

import warnings
warnings.filterwarnings("ignore")

# fix_yahoo_finance is used to fetch data
import yfinance as yf
yf.pdr_override()
```

[2]:
```
# input
# Airlines Stock
symbols = ['AAL','ALK','DAL','LUV','JBLU']
start = '2019-12-01'
end = '2020-04-14'
```

[3]:
```
df = pd.DataFrame()
for s in symbols:
    df[s] = yf.download(s,start,end)['Adj Close']
```

```
[*********************100%***********************]  1 of 1 completed
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```

[4]:
```
from datetime import datetime
from dateutil import relativedelta

d1 = datetime.strptime(start, "%Y-%m-%d")
d2 = datetime.strptime(end, "%Y-%m-%d")
delta = relativedelta.relativedelta(d2,d1)
print('How many years of investing?')
```

```
print('%s years' % delta.years)
```

```
How many years of investing?
0 years
```

[5]:
```
number_of_years = delta.years
```

[6]:
```
days = (df.index[-1] - df.index[0]).days
days
```

[6]:
```
133
```

[7]:
```
df.head()
```

[7]:

Date	AAL	ALK	DAL	LUV	JBLU
2019-12-02	27.976612	67.725922	56.361004	56.319195	19.200001
2019-12-03	27.189522	66.234383	55.238750	55.534775	18.799999
2019-12-04	27.279188	66.542633	55.675735	55.385830	19.320000
2019-12-05	27.139706	66.910545	55.496971	55.137600	19.139999
2019-12-06	27.627901	67.934738	55.755184	55.544704	19.020000

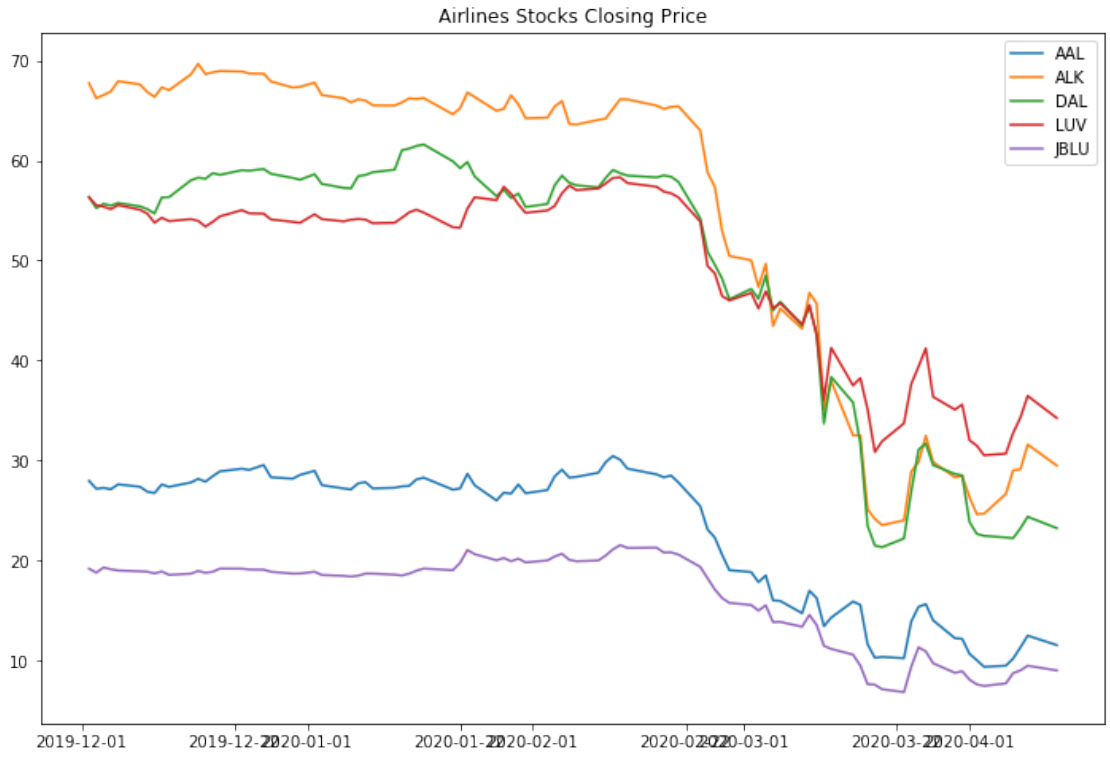
[8]:
```
df.tail()
```

[8]:

Date	AAL	ALK	DAL	LUV	JBLU
2020-04-06	9.50	26.670000	22.320000	30.700001	7.73
2020-04-07	10.22	29.030001	22.250000	32.770000	8.76
2020-04-08	11.33	29.139999	23.230000	34.299999	9.03
2020-04-09	12.51	31.610001	24.389999	36.470001	9.50
2020-04-13	11.56	29.510000	23.250000	34.259998	9.03

[9]:
```
plt.figure(figsize=(12,8))
plt.plot(df)
plt.title('Airlines Stocks Closing Price')
plt.legend(labels=df.columns)
```

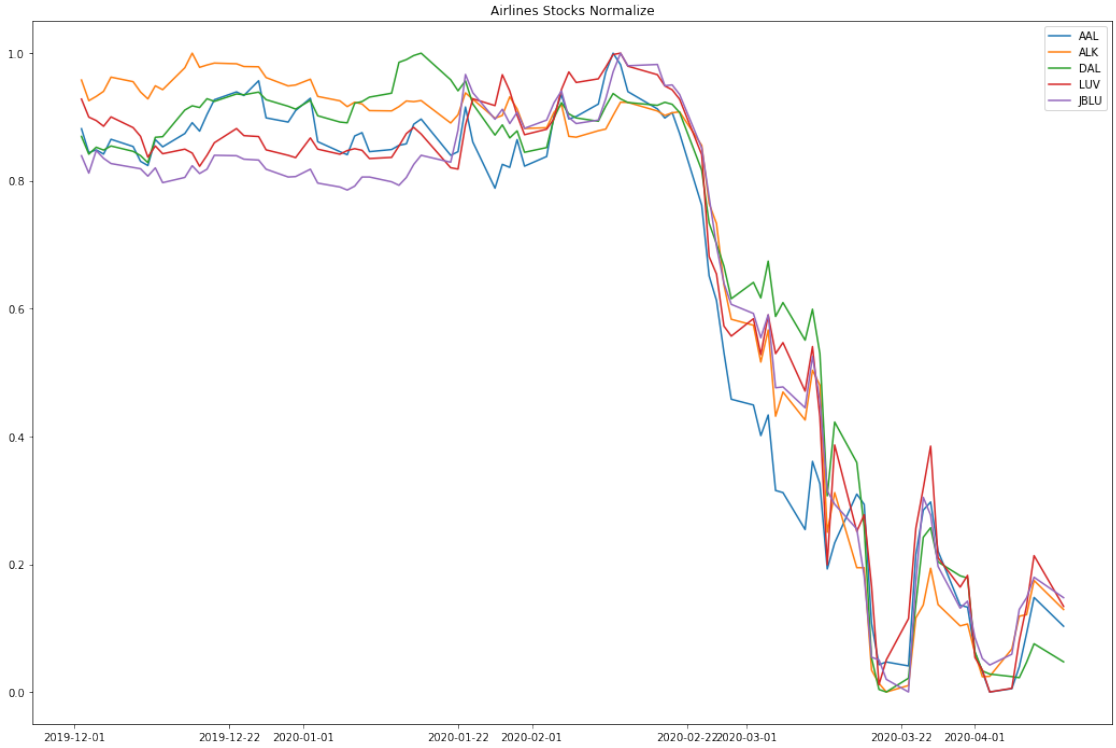
[9]:
```
<matplotlib.legend.Legend at 0x25e092eee10>
```



[10]:
```
# Normalize the data
normalize = (df - df.min())/ (df.max() - df.min())
```

[11]:
```
plt.figure(figsize=(18,12))
plt.plot(normalize)
plt.title('Airlines Stocks Normalize')
plt.legend(labels=normalize.columns)
```

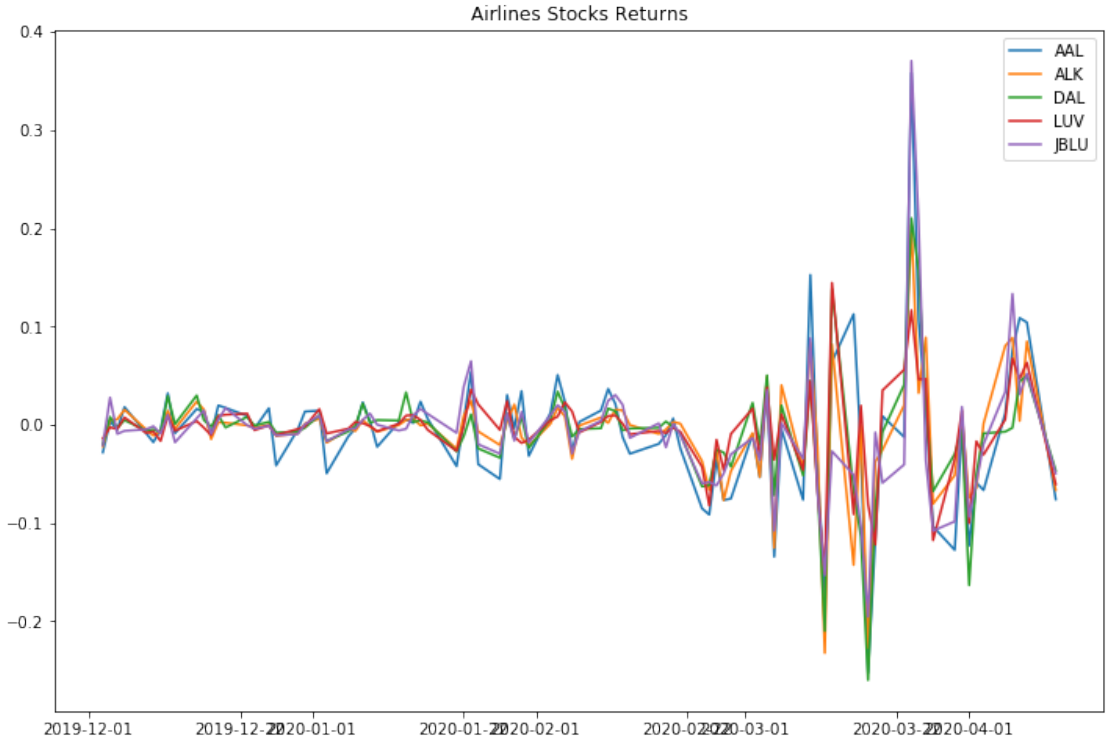
[11]: <matplotlib.legend.Legend at 0x25e09583390>



[12]:
```
stock_rets = df.pct_change().dropna()
```

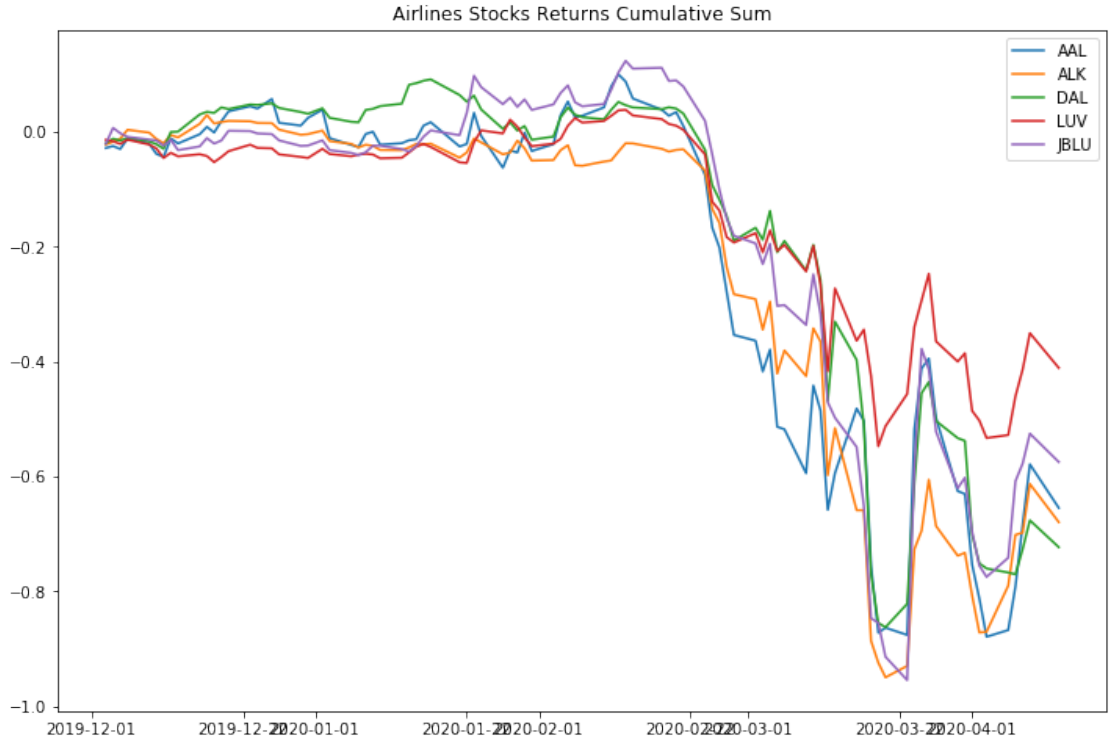
[13]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets)
plt.title('Airlines Stocks Returns')
plt.legend(labels=stock_rets.columns)
```

[13]: <matplotlib.legend.Legend at 0x25e0935d438>

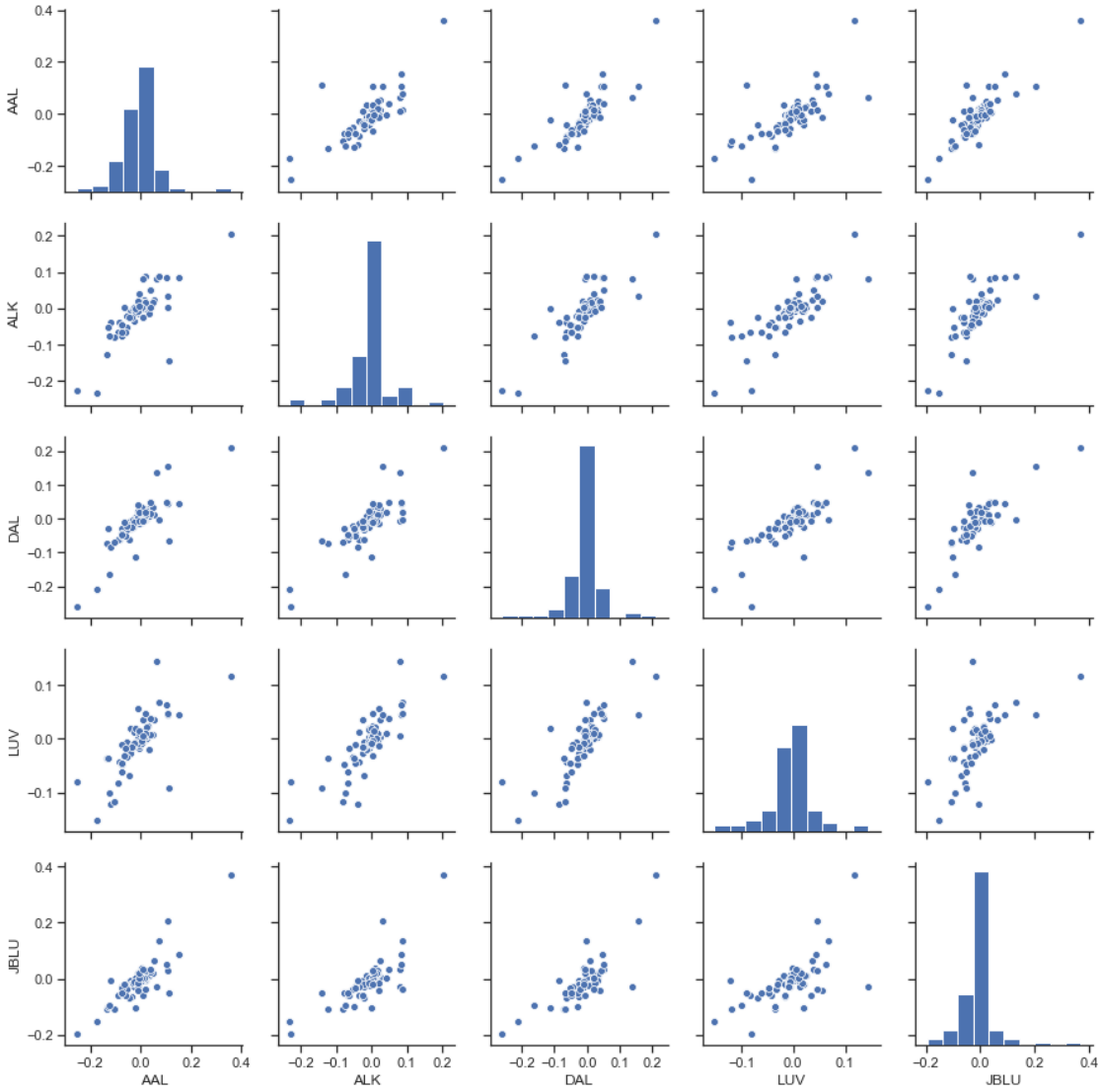


[14]:
```
plt.figure(figsize=(12,8))
plt.plot(stock_rets.cumsum())
plt.title('Airlines Stocks Returns Cumulative Sum')
plt.legend(labels=stock_rets.columns)
```

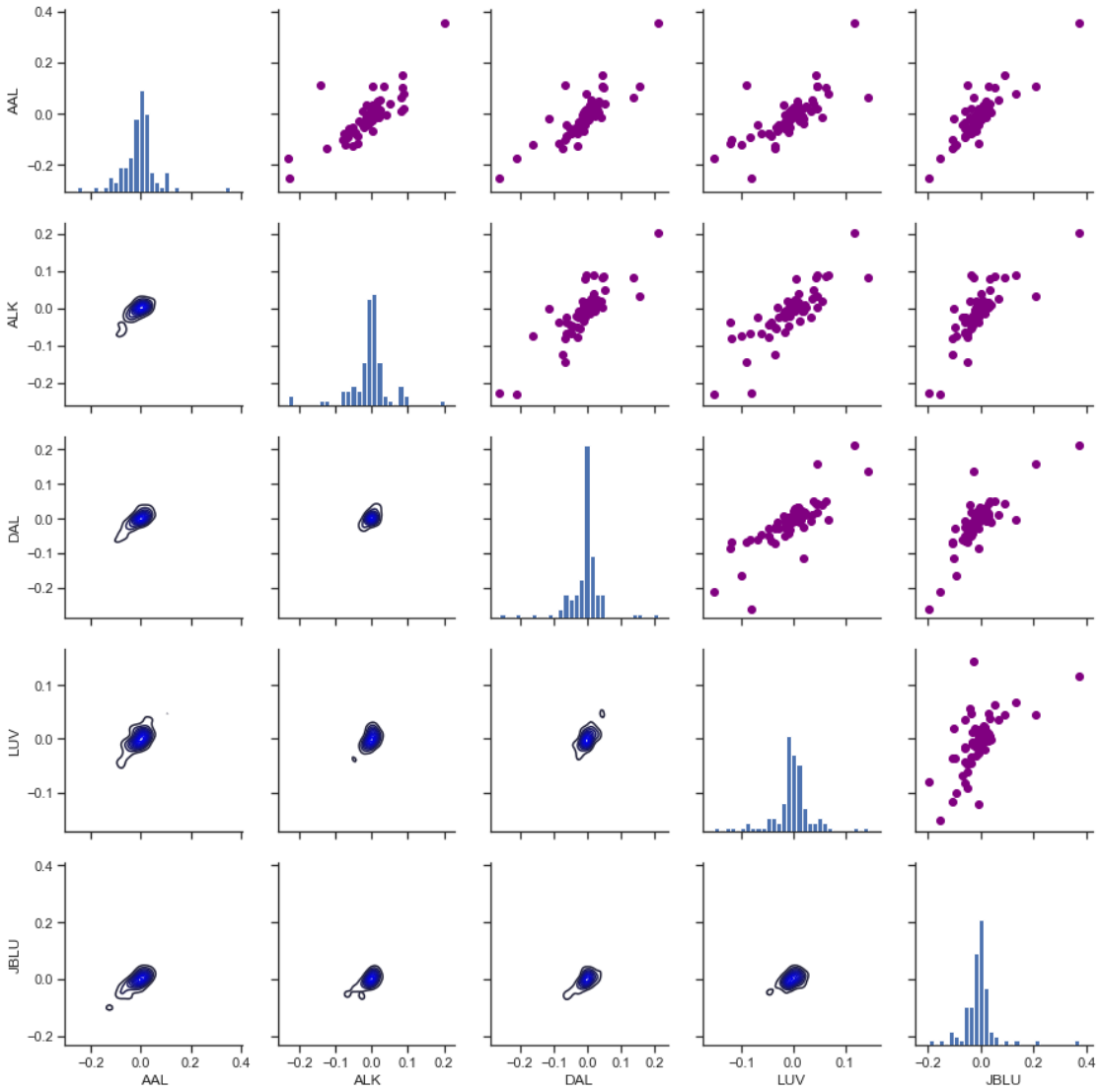
[14]: <matplotlib.legend.Legend at 0x25e093bd518>



[15]:
```
sns.set(style='ticks')
ax = sns.pairplot(stock_rets, diag_kind='hist')

nplot = len(stock_rets.columns)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```

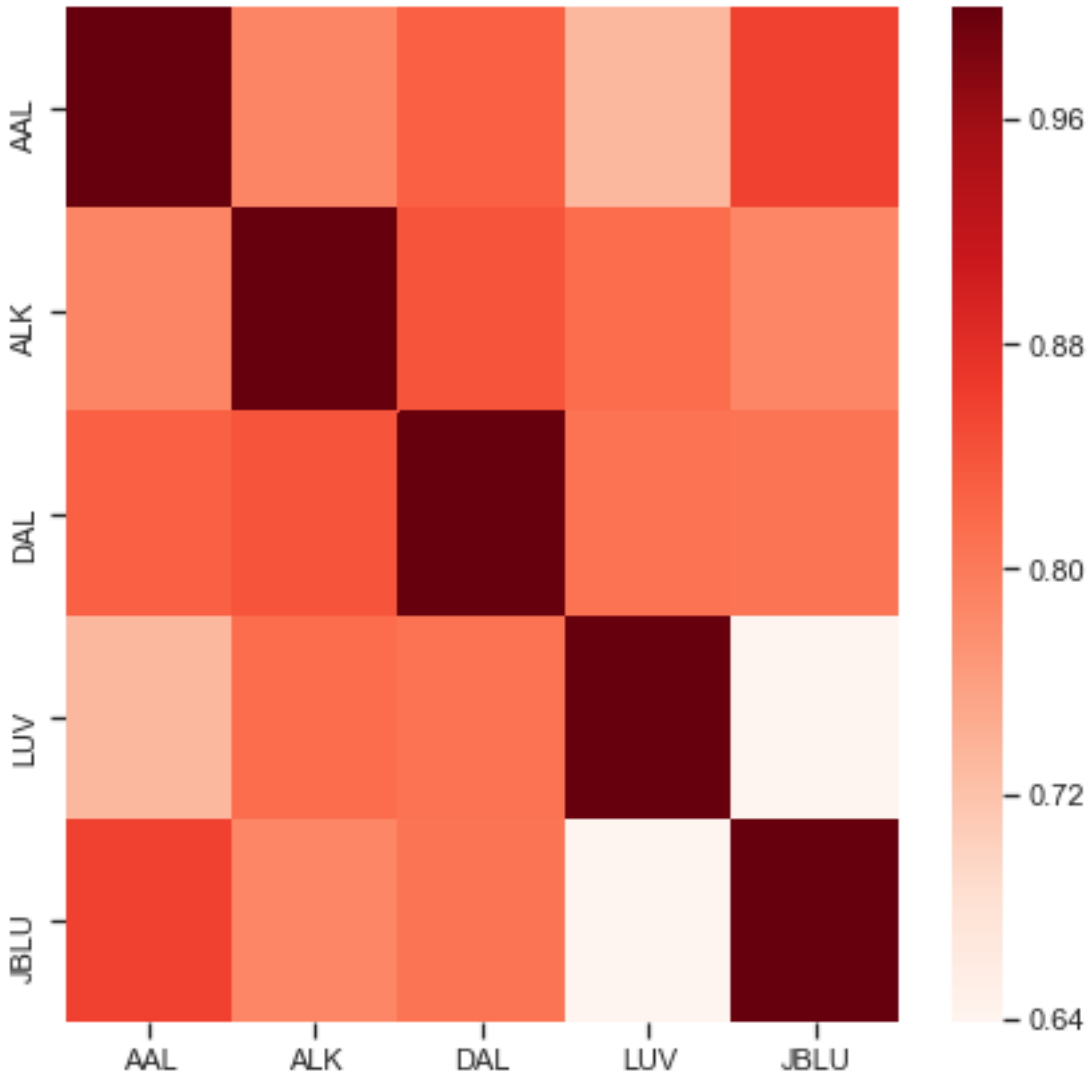


[16]:
```
ax = sns.PairGrid(stock_rets)
ax.map_upper(plt.scatter, color='purple')
ax.map_lower(sns.kdeplot, color='blue')
ax.map_diag(plt.hist, bins=30)
for i in range(nplot) :
    for j in range(nplot) :
        ax.axes[i, j].locator_params(axis='x', nbins=6, tight=True)
```



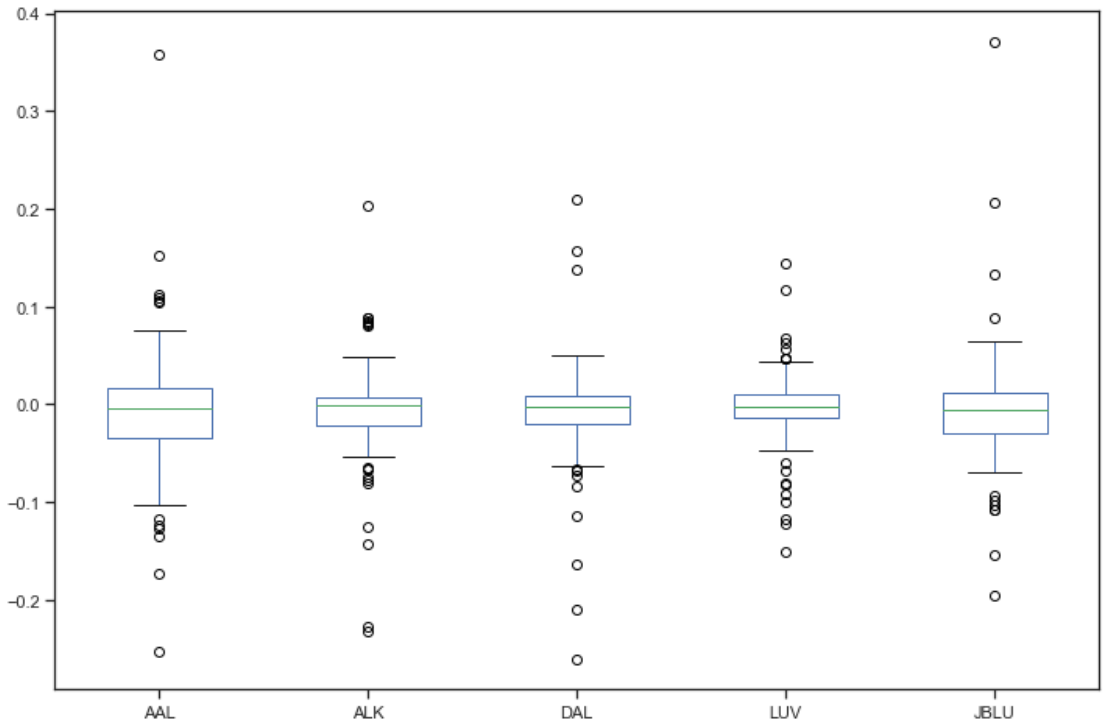
[17]:
```
plt.figure(figsize=(7,7))
corr = stock_rets.corr()

# plot the heatmap
sns.heatmap(corr,
        xticklabels=corr.columns,
        yticklabels=corr.columns,
            cmap="Reds")
```

[17]: <matplotlib.axes._subplots.AxesSubplot at 0x25e0cf26198>

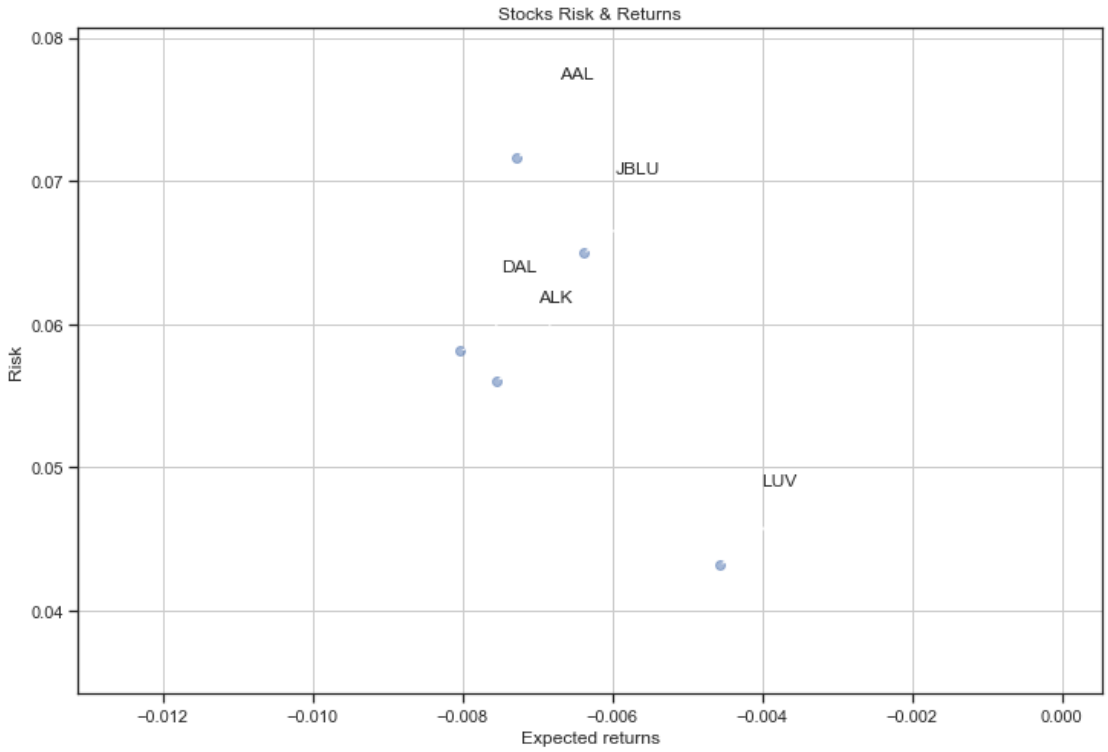


[18]:
```
# Box plot
stock_rets.plot(kind='box',figsize=(12,8))
```

[18]: <matplotlib.axes._subplots.AxesSubplot at 0x25e0d42d4e0>



[19]:
```
rets = stock_rets.dropna()

plt.figure(figsize=(12,8))
plt.scatter(rets.mean(), rets.std(),alpha = 0.5)

plt.title('Stocks Risk & Returns')
plt.xlabel('Expected returns')
plt.ylabel('Risk')
plt.grid(which='major')

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'))
```



[20]:
```
rets = stock_rets.dropna()
area = np.pi*20.0

sns.set(style='darkgrid')
plt.figure(figsize=(12,8))
plt.scatter(rets.mean(), rets.std(), s=area)
plt.xlabel("Expected Return", fontsize=15)
plt.ylabel("Risk", fontsize=15)
plt.title("Return vs. Risk for Stocks", fontsize=20)

for label, x, y in zip(rets.columns, rets.mean(), rets.std()) :
    plt.annotate(label, xy=(x,y), xytext=(50, 0), textcoords='offset points',
                 arrowprops=dict(arrowstyle='-',␣
 ↪connectionstyle='bar,angle=180,fraction=-0.2'),
                 bbox=dict(boxstyle="round", fc="w"))
```

[21]:
```
rest_rets = rets.corr()
pair_value = rest_rets.abs().unstack()
pair_value.sort_values(ascending = False)
```

[21]:
```
JBLU  JBLU    1.000000
LUV   LUV     1.000000
ALK   ALK     1.000000
DAL   DAL     1.000000
AAL   AAL     1.000000
      JBLU    0.859128
JBLU  AAL     0.859128
DAL   ALK     0.839744
ALK   DAL     0.839744
DAL   AAL     0.827899
AAL   DAL     0.827899
LUV   ALK     0.816276
ALK   LUV     0.816276
DAL   LUV     0.808675
LUV   DAL     0.808675
DAL   JBLU    0.807102
JBLU  DAL     0.807102
ALK   AAL     0.789153
AAL   ALK     0.789153
```

```
ALK   JBLU    0.787202
JBLU  ALK     0.787202
AAL   LUV     0.732962
LUV   AAL     0.732962
JBLU  LUV     0.638621
LUV   JBLU    0.638621
dtype: float64
```

[22]:
```
# Normalized Returns Data
Normalized_Value = ((rets[:] - rets[:].min()) /(rets[:].max() - rets[:].min()))
Normalized_Value.head()
```

[22]:

Date	AAL	ALK	DAL	LUV	JBLU
2019-12-03	0.367220	0.483075	0.510561	0.464128	0.308579
2019-12-04	0.418722	0.544336	0.569747	0.502181	0.394310
2019-12-05	0.404941	0.546345	0.546088	0.496091	0.328939
2019-12-06	0.442793	0.568799	0.562816	0.536239	0.334327
2019-12-09	0.399137	0.522557	0.540035	0.482827	0.337045

[23]:
```
Normalized_Value.corr()
```

[23]:

	AAL	ALK	DAL	LUV	JBLU
AAL	1.000000	0.789153	0.827899	0.732962	0.859128
ALK	0.789153	1.000000	0.839744	0.816276	0.787202
DAL	0.827899	0.839744	1.000000	0.808675	0.807102
LUV	0.732962	0.816276	0.808675	1.000000	0.638621
JBLU	0.859128	0.787202	0.807102	0.638621	1.000000

[24]:
```
normalized_rets = Normalized_Value.corr()
normalized_pair_value = normalized_rets.abs().unstack()
normalized_pair_value.sort_values(ascending = False)
```

[24]:
```
JBLU  JBLU    1.000000
LUV   LUV     1.000000
ALK   ALK     1.000000
DAL   DAL     1.000000
AAL   AAL     1.000000
      JBLU    0.859128
JBLU  AAL     0.859128
DAL   ALK     0.839744
ALK   DAL     0.839744
DAL   AAL     0.827899
AAL   DAL     0.827899
LUV   ALK     0.816276
ALK   LUV     0.816276
DAL   LUV     0.808675
```

```
LUV   DAL     0.808675
DAL   JBLU    0.807102
JBLU  DAL     0.807102
ALK   AAL     0.789153
AAL   ALK     0.789153
ALK   JBLU    0.787202
JBLU  ALK     0.787202
AAL   LUV     0.732962
LUV   AAL     0.732962
JBLU  LUV     0.638621
LUV   JBLU    0.638621
dtype: float64
```

[25]:
```
print("Stock returns: ")
print(rets.mean())
print('-' * 50)
print("Stock risks:")
print(rets.std())
```

```
Stock returns:
AAL    -0.007272
ALK    -0.007548
DAL    -0.008032
LUV    -0.004565
JBLU   -0.006384
dtype: float64
--------------------------------------------------
Stock risks:
AAL     0.071660
ALK     0.056064
DAL     0.058122
LUV     0.043218
JBLU    0.064988
dtype: float64
```

[26]:
```
table = pd.DataFrame()
table['Returns'] = rets.mean()
table['Risk'] = rets.std()
table.sort_values(by='Returns')
```

[26]:

	Returns	Risk
DAL	-0.008032	0.058122
ALK	-0.007548	0.056064
AAL	-0.007272	0.071660
JBLU	-0.006384	0.064988
LUV	-0.004565	0.043218

[27]:
```
table.sort_values(by='Risk')
```

[27]:
```
        Returns      Risk
LUV   -0.004565  0.043218
ALK   -0.007548  0.056064
DAL   -0.008032  0.058122
JBLU  -0.006384  0.064988
AAL   -0.007272  0.071660
```

[28]:
```
rf = 0.01
table['Sharpe Ratio'] = (table['Returns'] - rf) / table['Risk']
table
```

[28]:
```
        Returns      Risk  Sharpe Ratio
AAL   -0.007272  0.071660     -0.241029
ALK   -0.007548  0.056064     -0.312989
DAL   -0.008032  0.058122     -0.310245
LUV   -0.004565  0.043218     -0.337021
JBLU  -0.006384  0.064988     -0.252114
```

[29]:
```
table['Max Returns'] = rets.max()
```

[30]:
```
table['Min Returns'] = rets.min()
```

[31]:
```
table['Median Returns'] = rets.median()
```

[32]:
```
total_return = stock_rets[-1:].transpose()
table['Total Return'] = 100 * total_return
table
```

[32]:
```
        Returns      Risk  Sharpe Ratio  Max Returns  Min Returns  \
AAL   -0.007272  0.071660     -0.241029     0.358049    -0.252246
ALK   -0.007548  0.056064     -0.312989     0.203079    -0.232385
DAL   -0.008032  0.058122     -0.310245     0.210171    -0.259924
LUV   -0.004565  0.043218     -0.337021     0.144441    -0.151094
JBLU  -0.006384  0.064988     -0.252114     0.370262    -0.195378

      Median Returns  Total Return
AAL         -0.004230     -7.593923
ALK         -0.000512     -6.643468
DAL         -0.003102     -4.674044
LUV         -0.002829     -6.059783
JBLU        -0.005363     -4.947371
```

[33]:
```
table['Average Return Days'] = (1 + total_return)**(1 / days) - 1
table
```

[33]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
AAL	-0.007272	0.071660	-0.241029	0.358049	-0.252246	
ALK	-0.007548	0.056064	-0.312989	0.203079	-0.232385	
DAL	-0.008032	0.058122	-0.310245	0.210171	-0.259924	
LUV	-0.004565	0.043218	-0.337021	0.144441	-0.151094	
JBLU	-0.006384	0.064988	-0.252114	0.370262	-0.195378	

	Median Returns	Total Return	Average Return Days
AAL	-0.004230	-7.593923	-0.000594
ALK	-0.000512	-6.643468	-0.000517
DAL	-0.003102	-4.674044	-0.000360
LUV	-0.002829	-6.059783	-0.000470
JBLU	-0.005363	-4.947371	-0.000381

[34]:
```
initial_value = df.iloc[0]
ending_value = df.iloc[-1]
table['CAGR'] = ((ending_value / initial_value) ** (252.0 / days)) -1
table
```

[34]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
AAL	-0.007272	0.071660	-0.241029	0.358049	-0.252246	
ALK	-0.007548	0.056064	-0.312989	0.203079	-0.232385	
DAL	-0.008032	0.058122	-0.310245	0.210171	-0.259924	
LUV	-0.004565	0.043218	-0.337021	0.144441	-0.151094	
JBLU	-0.006384	0.064988	-0.252114	0.370262	-0.195378	

	Median Returns	Total Return	Average Return Days	CAGR
AAL	-0.004230	-7.593923	-0.000594	-0.812617
ALK	-0.000512	-6.643468	-0.000517	-0.792792
DAL	-0.003102	-4.674044	-0.000360	-0.813204
LUV	-0.002829	-6.059783	-0.000470	-0.610072
JBLU	-0.005363	-4.947371	-0.000381	-0.760526

[35]:
```
table.sort_values(by='Average Return Days')
```

[35]:

	Returns	Risk	Sharpe Ratio	Max Returns	Min Returns	\
AAL	-0.007272	0.071660	-0.241029	0.358049	-0.252246	
ALK	-0.007548	0.056064	-0.312989	0.203079	-0.232385	
LUV	-0.004565	0.043218	-0.337021	0.144441	-0.151094	
JBLU	-0.006384	0.064988	-0.252114	0.370262	-0.195378	
DAL	-0.008032	0.058122	-0.310245	0.210171	-0.259924	

	Median Returns	Total Return	Average Return Days	CAGR
AAL	-0.004230	-7.593923	-0.000594	-0.812617
ALK	-0.000512	-6.643468	-0.000517	-0.792792
LUV	-0.002829	-6.059783	-0.000470	-0.610072
JBLU	-0.005363	-4.947371	-0.000381	-0.760526

DAL	-0.003102	-4.674044	-0.000360	-0.813204