6. Calculate the performance of the two pairs picked. Use the various performance measures explained in the course.Two Pairs using two methods each.
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NOTE: I used PANDAS and data from QuanDL to calculate these measures.NOTE2: GOOG and GOOGL are two different stocks (https://www.investopedia.com/articles/markets/052215/goog-or-googl-which-google-should-you-buy.asp)

The two pairs:
-The smallest historical distance from the main industry that I picked, Software.(('GOOG', 'GOOGL'), 0.04045301814067839)

-The smallest historical distance for main industry (Software) and related industry (Semiconductors) pair is:(('GOOGL', 'XLNX'), 0.5245130065173396)

(At least) Two Methods:
-Sharpe measure
-Treynor measure
-Jensen Alpha
-Holding Period Return

#----------------
Pair One:The smallest historical distance from the main industry that I picked, Software.(('GOOG', 'GOOGL'), 0.04045301814067839)
(START)
#----------------

Holding Period Return:Formula:
https://en.wikipedia.org/wiki/Holding_period_returnFor GOOG:
0.418032 or 41.8032%
For GOOGL:0.38712 or 38.712%

Sharpe measure:# Sharpe measure## Sharpe measure is on total risk.# Sharpe Raito = (Rp - Rf)/std# Rp => Average return# Rf => Risk free rate# std => standard deviation## https://www.investopedia.com/terms/r/risk-freerate.asp#ixzz55B5Vc4ly# the interest rate on a three-month U.S. Treasury bill is often used as the risk-free rate for U.S.-based investors.## Risk free rate: https://ycharts.com/indicators/3_month_t_bill
For GOOG:Rp = df_goog_average_returnRf = 0.0133std = goog_std_returnsharpe_goog = (Rp - Rf) / std
Sharpe for GOOG: 1.4782398792731872
For GOOGL:Rp = df_googl_average_returnRf = 0.0133std = googl_std_returnsharpe_googl = (Rp - Rf) / std

Sharpe for GOOGL: 1.4620040368557

Treynor Measure:# Treynor measure## Similar to Sharpe except it only considers systematic risks# not total risk.## Treynor Raito = (Rp - Rf)/Beta# Rp => Average return# Rf => Risk free rate# Beta => Beta## https://www.investopedia.com/terms/r/risk-freerate.asp#ixzz55B5Vc4ly# the interest rate on a three-month U.S. Treasury bill is often used as the risk-free rate for U.S.-based investors.## Risk free rate: https://ycharts.com/indicators/3_month_t_bill## Beta - https://finance.yahoo.com/quote/GOOG?p=GOOG# https://finance.yahoo.com/quote/GOOGL?p=GOOGL
For GOOG:Rp = df_goog_average_returnRf = 0.0133Beta = 1.04treynor_goog = (Rp - Rf) / Beta
Treynor for GOOG: 0.14717192208828575
For GOOGL:Rp = df_googl_average_returnRf = 0.0133Beta = 1.01treynor_googl = (Rp - Rf) / Beta

Treynor for GOOGL: 0.14125357724113863

Jensen's Measure:# Jensen's Measure## Excess returns# alpha = Rp - [Rf - Beta(Rm - Rf)]# Rm is Market return. The market is the S&P 500 so using ticker symbol # SPX which follows the S&P 500.df_spx['daily_return'] = (df_spx['Adj Close'] / (df_spx['Adj Close'][1]))df_spx_average_return = df_spx['daily_return'].mean()
For GOOG:Rp = df_goog_average_returnRf = 0.0133Beta = 0.88Rm = df_spx_average_returngoog_jensen_alpha = Rp - (Rf - Beta*(Rm - Rf))
Jensen for GOOG: = 0.882301658875199
For GOOGL:Rp = df_googl_average_returnRf = 0.0133Beta = 0.88Rm = df_spx_average_returngoogl_jensen_alpha = Rp - (Rf - Beta*(Rm - Rf))
Jensen for GOOGL: = 0.8719089729169318

#----------------
Pair One:The smallest historical distance from the main industry that I picked, Software.(('GOOG', 'GOOGL'), 0.04045301814067839)
(END)
#----------------

#----------------
Pair Two:The smallest historical distance for main industry (Software) and related industry (Semiconductors) pair is:(('GOOGL', 'XLNX'), 0.5245130065173396)
(START)
#----------------
Sharpe measure:# Sharpe measure## Sharpe measure is on total risk.# Sharpe Raito = (Rp - Rf)/std# Rp => Average return# Rf => Risk free rate# std => standard deviation## https://www.investopedia.com/terms/r/risk-freerate.asp#ixzz55B5Vc4ly# the interest rate on a three-month U.S. Treasury bill is often used as the risk-free rate for U.S.-based investors.## Risk free rate: https://ycharts.com/indicators/3_month_t_bill
For GOOGL:Rp = df_googl_average_returnRf = 0.0133std = googl_std_returnsharpe_googl = (Rp - Rf) / std

Sharpe for GOOGL: 1.4620040368557
For XLNX:Rp = df_xlnx_average_returnRf = 0.0133std = xlnx_std_returnsharpe_xlnx = (Rp - Rf) / std
Sharpe for XLNX: 1.2894166002250353
Treynor Measure:# Treynor measure## Similar to Sharpe except it only considers systematic risks# not total risk.## Treynor Raito = (Rp - Rf)/Beta# Rp => Average return# Rf => Risk free rate# Beta => Beta## https://www.investopedia.com/terms/r/risk-freerate.asp#ixzz55B5Vc4ly# the interest rate on a three-month U.S. Treasury bill is often used as the risk-free rate for U.S.-based investors.## Risk free rate: https://ycharts.com/indicators/3_month_t_bill## Beta - https://finance.yahoo.com/quote/GOOG?p=GOOG# https://finance.yahoo.com/quote/GOOGL?p=GOOGL
For GOOGL:Rp = df_googl_average_returnRf = 0.0133Beta = 1.01treynor_googl = (Rp - Rf) / Beta
Treynor for GOOGL: 0.14125357724113863
For XLNX:Rp = df_goog_average_returnRf = 0.0133Beta = 0.88treynor_xlnx = (Rp - Rf) / Beta Treynor for XLNX: 0.17393045337706498

Jensen's Measure:# Jensen's Measure## Excess returns# alpha = Rp - [Rf - Beta(Rm - Rf)]# Rm is Market return. The market is the S&P 500 so using ticker symbol # SPX which follows the S&P 500.df_spx['daily_return'] = (df_spx['Adj Close'] / (df_spx['Adj Close'][1]))df_spx_average_return = df_spx['daily_return'].mean()
For GOOGL:Rp = df_googl_average_returnRf = 0.0133Beta = 0.88Rm = df_spx_average_returngoogl_jensen_alpha = Rp - (Rf - Beta*(Rm - Rf))
Jensen for GOOGL: = 0.8719089729169318
For XLNX:Rp = df_xlnx_average_returnRf = 0.0133Beta = 0.88Rm = df_spx_average_returnxlnx_jensen_alpha = Rp - (Rf - Beta*(Rm - Rf))
Jensen for XLNXL: = 0.8544309763096805

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Pair Two:The smallest historical distance for main industry (Software) and related industry (Semiconductors) pair is:(('GOOGL', 'XLNX'), 0.5245130065173396)
(END)
#----------------

These are the measure for the individual ticker symbol if one were to hold a buy and hold strategy. However, according to the Pairs Strategy, you take an open position whenthe separation of the stocks are 2 standard deviations in the Trading period. The excess returns is calculated in with the formula from the paper "Pairs Trading: Performance of a Relative Value Arbitrage Rule" (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=141615) on page 13 under secetion 2.3 Excess Return Computation. You short the winner and long the winner during the open period. To calculate the returns on stock in long position is straight forward. To calculate thethe returns on short position is a little bit different. How to calculate for short can be found here (https://www.quora.com/How-do-you-compute-return-on-a-short-sale).

Unfortunately, none of the pairs entered an open position during the trading period (i.e. more than 2 standard deviation.) You cannot measure the performance and calculate the excess returns on the pairs since they never performed.