**CS 7646 2015 Midterm**

**Student name:**

**GT ID:**

**Instructions:** This test is closed book, closed notes, closed Internet. You are allowed to use scrap paper and a simple calculator (not programmable). If you are unsure about a question, state any assumptions you make to solve the problem.

1p. Fill in section A, B, C, to complete code that correctly computes the Sharpe Ratio

```
import numpy as np
import pandas as pd
def get_sharpe_ratio(port_val, daily_rf=0, samples_per_year=252):
        daily_rets = (port_val / port_val.shift(1)) - 1
        daily_rets = daily_rets[1:]
        std_daily_ret = daily_rets.std()
        sharpe_ratio = np.sqrt(_A_) * (_B_).mean() / (_C_)
        return sharpe_ratio
```

A:

B:

C:

2 p. Fill in section A to complete code that will cause the following output:

```
import numpy as np
j = np.random.random([2,2])
print j
print _A_
```

Output:

```
[[ 0.1624438 ,  0.14157016],
[ 0.07818402,  0.85854546]]
[[ 1.        ,  1.        ],
[ 0.48129886,  6.06445229]])
```

Answer:

3p. Complete the following code for section A to create an empty pandas data frame indexed by dates

```
import pandas as pd
def create_dataframe():
        #Define date range
        start_date = '2010-02-01'
        end_date = '2010-12-01'
        dates = pd.date_range(start_date, end_date)
        #Create an empty pandas dataframe , indexed by dates
        df1 = _A_
```

Answer:

4p. Describe in words, the output of the following code:

```
import pandas as pd
def test_method():
        #Define date range
        start_date = '2009-12-01'
        end_date = '2010-12-01'
        dates = pd.date_range(start_date, end_date)
        #Choose stock symbols to read in
        symbols = ['GOOG', 'IBM']
        #Get stock data
        df = get_data(symbols, dates)
        print df.ix['2010-01-01':'2010-01-31']
```

Answer:

5f. Why (or why not) is Sharpe Ratio a better measure of portfolio performance than cumulative return?

Answer:

6f. As a hedge fund manger who employs the "two and twenty" fee model, you are managing a fund of $100,000,000 and for the year you make a return of -5%.

A. What is the profit/loss to your clients (not including fees)?

B. What fees do you collect as the manager?

C. If instead you had made a return of 15% for the year, what are the fees paid to the manager?

7p. Complete the output of the following code (fill in A, B, C, D).

```
import numpy as np
j = np.random.random([2,2])
print j
j[j<0.5] = 0
print j
```

Output:

```
[[ 0.93136269  0.16692318]
[ 0.97665527  0.33264659]]
[[ ___A____ ____B____]
[ ___C___ ____D____]]
```

A:

B:

C:

D:

8f. According to the Capital Assets Pricing Model (CAPM), what is the return, r_i for asset i, in terms of the return on the market, r_m?

Answer:

9f. Suppose we have a group of N assets in our portfolio with allocation w_i to each asset i, each with a specific Beta_i and alpha_i. Write an equation that describes the expected return of the entire portfolio in terms of the market return r_m.

Answer:

10f. Assume two stocks, A and B, that you'd like to combine into a portfolio with weights w_a, w_b respectively. You have calculated Beta values and estimated alphas for each. Your objective is to gain positive return while minimizing market risk. For a) & b) Utilize CAPM to find the weights that achieve this goal. c) Assuming your estimates of alpha are correct, what is your expected return?

Beta_a = 4 alpha_a = +4%
Beta_b = 2 alpha_b = -2%

A: w_a = ?

B: w_b = ?

C: r_p = ?

11f. Write the equation for Sharpe Ratio using 6 months of data assuming returns are calculated daily or weekly.

A: Daily:

B: Weekly:

12p. What is the output of the following code snippet (write each output line next to A) B) C))?

```
import numpy as np
A = np.ones((4,4))
w = np.array([0.1, 0.2, 0.3, 0.4])
print (A*w).sum()
print (A*w).sum(axis=1)
print (A*w).sum(axis=0)
```

A:

B:

C:

13p. What is the output of the following code snippet?

```
A = [1, 2, 3, 4, 5]
print A[0:-1]
print A[0:4]
print A[0:4:1]
```

A:

B:

C:

14f. Consider the order book for IBM below. Three orders arrive. At what price per share will each order be executed? (assume these three orders only and that they arrive in the order given)

| Bid/Ask, | Price, | Size |
|---|---|---|
| Ask, | 101, | 100 |
| Ask, | 100.2, | 200 |
| Ask, | 100, | 50 |
| Bid, | 99.5, | 500 |
| Bid, | 99, | 100 |
| Bid, | 98.5, | 200 |

A: BUY, IBM, 100 shares, LIMIT 99.5

B: BUY, IBM, 100 shares, LIMIT 101

C: BUY, IBM, 100 shares, MARKET

15f. A company promises to pay a $20 dividend starting one year from now and every year after that. Based on the riskiness of the company, you believe the discount rate should be 10% per year. Assume 0% inflation. Based on these factors only, what is the present value of this company?

Answer:

16f. Define each of these company valuation methods (one or two sentences or a formula):

A: Intrinsic value

B: Market capitalization

C: Book value

17f. Consider Stock ABC is currently priced at $50 on the stock exchange. Trader X is of the opinion that the price of the stock is going to dip to $20 in the next 3 days. She decides to short 100 shares of ABC when its price is at $50.

A: What is the maximum profit that Trader X can make?

B: What is the maximum loss that Trader X can experience?

18p. What is the output of the following Python code?

```
import numpy as np
x = np.array([[1,2],[3,4]])
y = np.array([[1,0],[0,1]])
print x*y
```

Answer:

19p. What is the output of the following Python code?

```
import pandas as pd
d = [[1,2], [3,4]]
df = pd.DataFrame(data=d)
print df.cumsum(axis=0)
print df.cumsum(axis=1)
```

A:

B:

20f. According to the CAPM, what is the expected value of alpha?

Answer:

21f. Consider two stocks, A and B. A has a Beta of 1.0 and B has a Beta of 2.0. Suppose we have purchased $10,000 of A, and shorted $10,000 of B.

A: Is it better for us if the market goes up or down?

B: Suppose the market goes down 10%, what is our expected return?

22p. Consider two Pandas dataframes dfA and dfB, we want to retain all rows of dfA and only those rows of dfB that are common to dfA. What single Python statement can accomplish this?

Answer:

23f. True or False: We should expect that higher Beta stocks are more volatile than low Beta stocks.

Answer:

24f. My portfolio has three stocks A, B, C, with the weights 0.3, 0.4 and 0.3. If their Beta values are 1, 3 and 4 respectively what is the Beta of the portfolio?

Answer:

25p. Assume that df_port_val is your price dataframe. Write an expressions to calculate daily returns and cumulative return.

A: daily_returns =

B: cumulative_return =

26f. If you see a stock's actual close price drop suddenly exactly 50% in a single day, what is likely to have happened?

Answer:

27f. The adjusted close data we use in the class was collected in 2012. If you were to collect the same data today (say from Yahoo Finance) and look at price data in 2010…

A: Would you expect the adjusted close data collected today for 2010 to be the same as the data collected in 2012?

B: Why or why not?

28f. In terms of trading and liquidity, describe at least two differences between ETFs and mutual funds.

A:

B:

Solutions

1p
A: samples_per_year
B: daily_rets - daily_rf
C: std_daily_ret

2p
A: j / j[0,:]

3p
A: pd.DataFrame(index=dates)

4p The code prints a pandas data frame with stock values for GOOG and IBM for the month of January 2010.

5f. Sharpe Ratio is the risk adjusted return and takes into account the volatility, giving a better probabilistic approximation of the return than cumulative return.

6f. For this problem it is OK if they consider the fees at the end of the year. Be liberal

A. .05 * 100,000,000 = $5,000,000
B. No loss, profit of .02 * 100,000,000 = 2,000,000
C. (.02 * 100,000,000) + (.2 * 13,000,000) = $4,600,000

7p.
A: 0.93136269 B: 0.
C: 0.97665527 D: 0.

8f.
r_i = beta_i * r_m + alpha_i
also allowed: r_i = beta_i * (r_m – r_risk_free) + alpha_i

9f.
r_p = Sum_i(w_i * (Beta_i * r_m + alpha_i))

10f.

a) w_a =.33
b) w_b =-.66
c) ?

11f.

a) SR = SQRT(252) * mean(daily_ret – risk_free) / stdev(daily_ret) [OK if they leave out risk_free
b) SR = SQRT(52) * mean(weekly_ret – risk_free) / stdev(weekly_ret) [OK if they leave out risk_free

12p.
A: 4.0

```
B: [ 1.  1.  1.  1.]
C: [ 0.4  0.8  1.2  1.6]
```

13p.

```
A: [1,2,3,4]
B: [1,2,3,4]
C: [1,2,3,4,5]
```

14f.
A: Nothing executed
B: (50*100 + 50*100.2) / 2 = 100.1
C: 100.2

15f:
20/.1 = $200

16f. Define each of these company valuation methods:

A: Intrinsic value: A value based on dividends paid. PV = FV/discount

B: Market capitalization: Shares outstanding * Current market price

C: Book value: Sum of assets (excluding intangible assets) – sum of liabilities

17f.
A: $50 * 100 = $5,000
B: Infinite loss is possible

18p.

```
array([[1,0],
       [0,4]])
```

[note, it is OK if "array" is missing]

19p.
A:

```
1   2
4   6
```

B:

```
1   3
3   7
```

20f.
0.0 or zero

21f.
A: It is better if the market goes down because we are short B with a beta of 2.0
B: If the market goes down 10% we will lose $1000 on A, but gain $2000 on B, so net gain of $1000

22p.
dfA.join(dfB)

23f.
true

24f.
0.3 * 1 + 0.4 * 3 + 0.3 * 4 =
0.3 + 1.2 + 1.2 = 2.7

25p.
```
daily_returns= (port_val[1:]/port_val[:-1].values) - 1
cum_ret=(port_val[-1]/port_val[0])-1
```

26f. The stock split.

27f.

A: No, the data should be different.

B: The data is different because there have been splits and dividends that have forced changes in the adjusted closing values.

28f.
Intra-day trading vs End of day trading on Net Asset Value prices
Most ETFs have index trackers - operating cost decreases vs Mutual funds which require active management throughout
ETF trading can happen directly between investors - None of the overhead and paperworks found in mutual funds
No investment minimums in ETF - just the minimum unit of a stock vs investment minimums and sales loads enforced on mutual funds