1. (3 points) List the three elements that must be present for there to be arbitrage.

   - No risk
   - No net investment
   - Guaranteed positive cash flow or profit

2. (4 points) Sarah and Kristen enter into a financial agreement. Under this agreement, Sarah has the right but not the obligation to sell Iyer Stock to Kristen for 120 at the end of six months. If Sarah decides to sell the stock, Kristen must buy the stock. Under this agreement, Sarah must pay Kristen a fee today of 13. Iyer stock currently has a spot price of 121 and does not pay a dividend. The annual effective risk free interest rate is 3%.

   Mark each of the following true or false with regard to this situation.

   Sarah has entered into a long call.
   
   True  False

   This is an American Style option.
   
   True  False

   This option is in the money.
   
   True  False

   If the price of Iyer Stock is 107 at the end of six months, Sarah and Kristen will both have a profit of zero.
   
   True  False
3. (4 points) Tracy’s Creations makes and sells gold jewelry. Tracy will need 2000 ounces of gold at the end of each of the next three years to mold into her exquisite creations. Tracy is worried about the future price of gold so she wants to lock in the price of gold today by entering into a swap contract.

You are given the following spot interest rates:

<table>
<thead>
<tr>
<th>Period of Time</th>
<th>Spot Interest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year</td>
<td>0.050</td>
</tr>
<tr>
<td>2 Years</td>
<td>0.057</td>
</tr>
<tr>
<td>3 Years</td>
<td>0.065</td>
</tr>
<tr>
<td>4 Years</td>
<td>0.075</td>
</tr>
</tbody>
</table>

You are also given the following forward prices for gold:

<table>
<thead>
<tr>
<th>Period of Time</th>
<th>Forward Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year</td>
<td>1200</td>
</tr>
<tr>
<td>2 Years</td>
<td>1260</td>
</tr>
<tr>
<td>3 Years</td>
<td>1300</td>
</tr>
<tr>
<td>4 Years</td>
<td>1325</td>
</tr>
</tbody>
</table>

Determine the swap rate that Tracy will pay under the swap contract.

Solution:

\[
\left(\frac{1}{1.05}\right)(1200) + \left(\frac{1}{1.05^2}\right)(1260) + \left(\frac{1}{1.05^3}\right)(1300) + \left(\frac{1}{1.065}\right)^2 + \left(\frac{1}{1.065}\right)^3 = 1251.018195 \rightarrow \$1251.02
\]
4. (5 points) The stock of Kinney Corporation has a current spot price of 79 per share. Kinney Corporation pays a dividend of 2 per quarter with the next dividend payable in 2 months.

The annual effective risk free interest rate is 5%.

Calculate the prepaid forward price on Kinney Corporation where the stock is delivered in 12 months.

Solution:

\[ S_0 - \sum d_t e^{-rt} = \]

\[ 79 - 2(1.05)^{-\frac{2}{12}} - 2(1.05)^{-\frac{5}{12}} - 2(1.05)^{-\frac{8}{12}} - 2(1.05)^{-\frac{11}{12}} \]

\[ = 71.21 \]
5. (1 point) Circle the graph that represents the profit on a Floor.

The margin requirement for Charlene is 12% while her maintenance margin is 90%. Charlene will earn an interest rate of 7.8% compounded continuously on her margin account. The futures contract is marked to market weekly with any gain or loss being added or subtracted from the margin account.

At the end of one week, the futures price has fallen to $P$. After the mark to market, Charlene receives a margin call of 42,747.45.

Determine $P$.

**Solution:**

$$ (6)(250)(2230) = 3,345,000 \rightarrow 3,345,000(.12) = 401,400 = \text{Margin} $$

$$ 401,400(.9) = 361,260 = \text{Maintenance} $$

$$ 401,400e^{0.078(\frac{1}{52})} = 402,002.5518 = \text{Interest after 1 week} $$

$$ 402002.55 - X(6)(250) = 401,400.00 - 42,747.45 $$

$$ 402002.55 - 1500X = 358652.55 $$

$$ 43350 = 1500X $$

$$ X = 28.9 $$

$$ P = 2230 - X = 2230 - 28.90 = $2201.10 $$
7. Today, Alexandra bought a 9 month 23-strike European-style call on the stock of Dilcher Corporation. Dilcher has a current spot price of 20 and does not pay a dividend. The annual effective risk free interest rate is 6%. This call has a premium of 1.20.

Also, today, Alexandra’s friend Jake sold a 9 month 23-strike European-style put on the stock of Dilcher Corporation.

At the end of 9 months, the spot price of Dilcher is 24.

(3 points) Determine Alexandra’s profit from her call option.

Solution:

\[
\begin{array}{|c|c|c|c|}
\hline
\text{Spot} & \text{Payoff} & \text{FV of Cost} & \text{Profit} \\
\hline
24 & \text{Max}[0, \text{spot-strike}]: 24-23=1 & 1.20(1.60)^{\frac{3}{4}} = 1.2536 & \text{Payoff- FV of cost}: 1 - 1.2536 = -0.25 \\
\hline
\end{array}
\]

(5 points) Determine Jake’s profit on his put option.

Solution:

\[
C - P = S_o - \frac{k}{1+r}
\]

\[1.20 - P = 20 - \frac{23}{1.06^{\frac{3}{4}}} \]

\[P = 3.2165 \rightarrow 3.22 \]

\[
\begin{array}{|c|c|c|c|}
\hline
\text{Spot} & \text{Payoff} & \text{FV of Cost} & \text{Profit} \\
\hline
24 & \text{Max}[0, \text{strike-spot}]: 0 & -3.22 \left(1.06^{\frac{3}{4}}\right) = -3.3638 & \text{Payoff- FV of cost}: 0 - (-3.36) = 3.36 \\
\hline
\end{array}
\]
8. (4 points) You want to buy 1000 shares of Dietz Inc. which has a current ask price of $S. The bid-ask spread on the stock is 0.55.

You have the choice of using the following two brokers to make this purchase:

a. Dalrymple Discount Brokers who charge a commission of 0.75% of the purchase price; or

Determine the range of prices for which you should use Dalrymple Discount Brokers in order to minimize your transactions costs.

**Solution:**

\[
1000(x) + 1000(x)(0.0075) = 1000x + 102.50
\]

\[
1000(1.0075)x = 1000x +102.50
\]

\[
1007.5x -1000x =102.50
\]

\[
x=\frac{102.50}{7.5}=13.67
\]

Use Dalrymple Discount Brokers for prices less than $13.67 to minimize transaction costs.
9. (4 points) Sammie sells the stock of Cao Company for 52.50. Six months from now, Sammie will buy the stock of Cao to close out her position. The annual effective risk free interest rate is 7%.

Complete the following payoff and profit table. Show your work to receive full credit.

<table>
<thead>
<tr>
<th>Spot Price at End of 6 Months</th>
<th>Payoff</th>
<th>Future Value of Cost</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>-35</td>
<td>-54.31</td>
<td>19.31</td>
</tr>
<tr>
<td>45</td>
<td>-45</td>
<td>-54.31</td>
<td>9.31</td>
</tr>
<tr>
<td>50</td>
<td>-50</td>
<td>-54.31</td>
<td>4.31</td>
</tr>
<tr>
<td>55</td>
<td>-55</td>
<td>-54.31</td>
<td>-0.69</td>
</tr>
<tr>
<td>65</td>
<td>-65</td>
<td>-54.31</td>
<td>-10.69</td>
</tr>
</tbody>
</table>
10. (1 point) The profit on a loan is equal to the cost on a forward contract.

True  False

11. (2 points) Circle each of the following that is a derivative:

i. Insurance to protect the contents of your apartment or dorm room.

ii. Apple Stock

iii. An agreement to purchase 100 shares of Amazon stock at the end of 6 months for a price of 200.

iv. A Zero Coupon Bond
12. (5 points) Toweson Airlines entered into a five year interest rate swap two years ago. Under the five year swap, Toweson agreed to borrow 100,000 each year for five years. Further, Toweson swapped the variable interest rate for a fixed interest rate of 6.5%. Now there are three years left on the swap agreement.

Today, the spot interest rates are:

<table>
<thead>
<tr>
<th>Period of Time</th>
<th>Spot Interest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year</td>
<td>0.050</td>
</tr>
<tr>
<td>2 Years</td>
<td>0.057</td>
</tr>
<tr>
<td>3 Years</td>
<td>0.065</td>
</tr>
<tr>
<td>4 Years</td>
<td>0.075</td>
</tr>
<tr>
<td>5 Years</td>
<td>0.080</td>
</tr>
</tbody>
</table>

Calculate the market value of the swap if Toweson decided sell it today.

**Solution:**

Use forward rates for years 2 and 3:

Year 2: \(1.05x = 1.057^2 \rightarrow x = 1.06404667\)

Year 3: \(1.057^2x = 1.065^3 \rightarrow x = 1.081182104\)

\[
\frac{0.05 - 0.065}{1.05} + \frac{0.06405 - 0.065}{1.057^2} + \frac{0.08118 - 0.065}{1.065^3} = -0.00174266
\]

\(-0.00174266(100,000) = -$174.27\)
13. The stock of Beckley Corporation does not pay dividends and has a current spot price of 147. The following are the premiums for 6 month European-style calls on Beckley Corporation stock:

<table>
<thead>
<tr>
<th>Strike Price</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>16.50</td>
</tr>
<tr>
<td>147</td>
<td>12.50</td>
</tr>
<tr>
<td>155</td>
<td>8.85</td>
</tr>
</tbody>
</table>

The annual effective risk free interest rate is 6.2%.

Simon purchases a strangle on Beckley Corporation stock by buying a put and a call.

(5 points) Determine the cost to purchase this strangle.

Solution:

For buying a strangle, buy a put with a strike price lower than the current spot price and buy a call with a strike price higher than the current spot price. So for this strangle, buy a put with a strike price of 140 and a call with a strike price of 155. Because only call prices are given, use the put-call parity equation to find the price of the put.

\[ C - P = S_o - \frac{k}{1+r} \]

\[ 16.50 - P = 147 - \frac{140}{(1.062)^{0.5}} \]

\[ P = 16.50 - 11.148 = 5.35 \]

Cost = 5.35 + 8.85 = $14.20

(1 point) Determine the payoff if the price of the stock is 145 at the end of 6 months.

Solution:

Payoff of Put = Max[0, strike-spot] = Max[0, (140-145)] = Max[0, -5] \(\rightarrow 0\)

Payoff of Call = Max[0, spot-strike] = Max[0, (145-155)] = Max[0, -1] \(\rightarrow 0\)

Total payoff = 0+0 = 0

(2 point) Determine the profit if the price of the stock is 165 at the end of 6 months.

Solution:

<table>
<thead>
<tr>
<th>Spot</th>
<th>Payoff</th>
<th>FV Cost</th>
<th>Profit</th>
<th>Payoff</th>
<th>FV Cost</th>
<th>Profit</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>165-155=10</td>
<td>8.85(1.062)^{0.5}=9.11</td>
<td>10-9.11=.89</td>
<td>0</td>
<td>5.35(1.062)^{0.5}=5.51</td>
<td>-5.51</td>
<td>.89-5.11=-$4.62</td>
</tr>
</tbody>
</table>
14. (5 points) The stock of Beckley Corporation does not pay dividends and has a current spot price of 147. The following are the premiums for 6 month European-style calls on Beckley Corporation stock:

<table>
<thead>
<tr>
<th>Strike Price</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>16.50</td>
</tr>
<tr>
<td>147</td>
<td>12.50</td>
</tr>
<tr>
<td>155</td>
<td>8.85</td>
</tr>
</tbody>
</table>

The annual effective risk free interest rate is 6.2%.

Huining enters into a Cap on Beckley Stock. Calculate the payoff and profit on the Cap if the spot price of Beckley Stock is 130 in 6 months.

**Solution:**

For a cap, sell the stock and buy a call at the current spot price.

<table>
<thead>
<tr>
<th>Stock</th>
<th>Call</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot</td>
<td>Payoff</td>
<td>FV Cost</td>
</tr>
<tr>
<td>130</td>
<td>-130</td>
<td>-147(1.062)^.5=-151.49</td>
</tr>
</tbody>
</table>
15. (4 points) There are four uses of derivatives. There are four situations described below. Each represents one of those uses. Please state which use is illustrated. Each use will be used once.

Tim believes that the stock of Sharp Inc. will increase over the next year. Tim can either purchase the stock of Sharp or he can purchase a forward contract on Sharp. Tim decides to buy the forward contract because the compensation that he will pay his broker is less.

Use: reduce transaction costs

John bought Apple Stock six years ago. The stock has tripled in price over the last six years. Even though he still believes that Apple Stock is a good long term investment, John is worried about the stock price decreasing in the short term. He could sell the stock but would have to pay tax on the gain in the price. He decides to buy a put instead which will protect him if the stock goes down without paying tax on the gain at this time.

Use: regulatory arbitrage

Cassidy just bought a new car. She decides to buy automobile insurance in case she would have a wreck.

Use: risk management

Yifei believes that the price of XU INC. will be very volatile over the next 6 months. Therefore, he purchases a straddle on XU INC hoping to capitalize on the volatility.

Use: speculation

16. (2 points) Mark the following statements as True or False.

A futures contract is an exchange traded forward contract.

True   False

A futures contract eliminates credit risk.

True   False
17. (4 points) The stock of Smith Company sells for 21.50. Smith Company stock does not pay a dividend. You are given the following premiums for one year European-style options on Smith Company:

<table>
<thead>
<tr>
<th>Strike Price</th>
<th>Call Premium</th>
<th>Put Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>3.50</td>
<td>1.00</td>
</tr>
<tr>
<td>25</td>
<td>1.30</td>
<td>3.55</td>
</tr>
</tbody>
</table>

The annual effective risk free interest rate is 5.25%.

Tyler enters into a collar on Smith Company using the above options.

Determine the maximum profit that Tyler can realize at the end of one year.

Solution:

For entering into a collar, buy a put at a strike price lower than the current spot rate and sell a call at a strike price higher than the current spot rate. The maximum profit occurs when the spot price is 0.

<table>
<thead>
<tr>
<th>Spot</th>
<th>Put</th>
<th>Call</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payoff</td>
<td>FV Cost</td>
<td>Profit</td>
<td>Payoff</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>1.00(1.0525) = 1.0525</td>
<td>20-1.0525 = 18.95</td>
</tr>
</tbody>
</table>
18. (4 points) The stock of Smith Company sells for 21.50. Smith Company stock does not pay a dividend. You are given the following premiums for one year European-style calls on Smith Company:

<table>
<thead>
<tr>
<th>Strike Price</th>
<th>Call Premium</th>
<th>Put Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>3.50</td>
<td>1.00</td>
</tr>
<tr>
<td>25</td>
<td>1.30</td>
<td>3.55</td>
</tr>
</tbody>
</table>

The annual effective risk free interest rate is 5.25%.

Phin enters into a bear spread on Smith Company using the above options.

Determine the range of spot prices at the end of one year for which Phin will realize a positive profit.

**Solution:**

For a bear spread with calls, sell a call at a strike price lower than the current spot price and buy a call at a strike price higher than the current spot price. There will be a positive profit from 0 to X, a positive number between 20 and 25.

<table>
<thead>
<tr>
<th>Spot</th>
<th>Payoff</th>
<th>FV Cost</th>
<th>Profit</th>
<th>Payoff</th>
<th>FV Cost</th>
<th>Profit</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>(20-X)</td>
<td>-3.50(1.0525)= -3.68</td>
<td>(20-X)+3.68</td>
<td>0</td>
<td>1.30(1.0525)= 1.37</td>
<td>-1.37</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Profit= 0=(20-X)+3.68-1.37

X= 22.31
19. (4 points) Hansen stock has a current spot price of 120. Hansen stock does not pay a dividend. The annual effective risk free interest rate is 8.16%. A six month forward contract on Hansen stock has a forward price of 126.

State in detail what actions Madi should take to take advantage of the arbitrage that exists in the market. Specifically, state what financial instruments Madi should buy or sell and when.

Solution:

Theoretical Forward Price = 120(1.0816)^{0.5} = $124.8

Real Forward Price = $126

Buy low (theoretical forward) and sell high (real forward):

Therefore, buy the synthetic forward which means that you buy the stock using borrowed money and sell the real forward.
20. (1 point) Draw the graph of a straddle.

![Graph of a straddle](image)

21. (1 point) If you have a positive cost, you are in the long position.

True [ ] False [ ]

22. (1 point) A long position on forward contract means that the owner is obligated to sell the underlying stock on the expiration date.

True [ ] False [ ]

23. (1 point) A long forward has the same payoff as a long stock.

True [ ] False [ ]
24. (5 points) The Shanghai Composite Index has a current spot price of $S_0$. The Index pays dividends at a rate of 1.2% payable continuously.

The risk free interest rate is 4.4% compounded continuously.

The forward price for a 7 month forward on the Shanghai Composite Index is 4584.79. Calculate $S_0$.

Solution:

$S_0(e^{-rt})(e^{rt}) = \text{forward price}$

$S_0e^{-0.012(\frac{7}{12})}e^{0.044(\frac{7}{12})} = 4584.79$

$S_0 = \frac{4584.79}{1.01884198}$

$S_0 = 4500$
25. (6 points) Pitman Corporation borrows money from Basham Bank for the next three years. Under this arrangement, Pitman will borrow $1,000,000 for the next year. Additionally, Pitman will borrow a total of 2,000,000 during the second year and a total of 3,000,000 during the third year.

Pitman has agreed to pay Basham the one year spot interest rate each year. Pitman wants to hedge the risk of changing interest rates and lock in a fixed interest rate for the next three years. In order to do this, Pitman enters into an interest rate swap.

You are given the following spot interest rates:

<table>
<thead>
<tr>
<th>Period of Time</th>
<th>Spot Interest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year</td>
<td>0.050</td>
</tr>
<tr>
<td>2 Years</td>
<td>0.057</td>
</tr>
<tr>
<td>3 Years</td>
<td>0.065</td>
</tr>
<tr>
<td>4 Years</td>
<td>0.075</td>
</tr>
</tbody>
</table>

Determine Pitman’s fixed interest rate under the interest rate swap.

**Solution:**

Use forward rates for years 2 and 3:

Year 2: $1.05x = 1.05^2 \rightarrow x = 1.06404667$

Year 3: $1.057^2 x = 1.065^3 \rightarrow x = 1.081182104$

$$R = \frac{(1,000,000)\left(\frac{1}{1.05}\right)(0.05) + (2,000,000)\left(\frac{1}{1.05^2}\right)(0.06405) + (3,000,000)\left(\frac{1}{1.065^3}\right)(0.08118)}{(1,000,000)\left(\frac{1}{1.05}\right) + (2,000,000)\left(\frac{1}{1.05^2}\right) + (3,000,000)\left(\frac{1}{1.065^3}\right)}$$

$$= 0.06963003 \rightarrow 6.963\%$$
26. (2 points) There are three styles of options. For each situation below, state which style of option is being described.

Mengyun has the right to buy Wang Corporation stock on December 31, 2015 for a price of 36.

What style of option is this? ___________ European ______________

Linhan has the right to sell the stock of Song Corporation at any time before December 31, 2015 for price of 832.

What style of option is this? ___________ American ______________

27. (5 points) List the five differences between forward and futures contracts.

- Futures are liquid
- Futures minimize credit risk
- Futures are marked to market daily, and forwards are exercised at expiration dates
- Futures are standardized, and forwards are customized
- Futures have price limits