**Finance 436 – Futures and Options**
**Review Notes for Midterm Exam II**

## Chapter 5

1.  Investment assets vs. consumption assets
2.  Short selling
3.  Forward price for an investment asset that provides no income - (5.1)
4.  Forward price for an investment asset that provides a known cash income - (5.2)
5.  Forward price for an investment asset that provides a known dividend yield - (5.3)
6.  Forward prices and futures prices
7.  Stock index futures - using (5.3) (concepts and calculations)
8.  Currency futures - using (5.3)
9.  Commodity futures (concepts)
10. Cost of carry (concepts)
11. Examples discussed in class and assignments

## Chapter 6

1.  Day count and quotation conventions - three day counts
2.  T-bond futures
3.  T-bill futures
4.  Duration: concepts and calculations
5.  Duration based hedging
6.  Speculation and hedging with interest rate futures
7.  Examples discussed in class and assignments

## Chapter 7

1.  Swaps
2.  Interest-rate swaps (concepts and applications)
3.  Role of financial intermediary (concepts and applications)
4.  Comparative advantage (concepts and applications)
5.  Currency swaps (concepts and applications)
6.  Other types of swaps
7.  Examples discussed in class and assignments

## Chapter 8

1.  Securitization
2.  Asset-backed security (ABS) - concepts
3.  Collateralized debt obligation (CDO) - concepts
4.  The U.S. housing market
5.  What went wrong?
6.  Aftermath

**Sample Problems**

## Chapter 5
Problem 5.12
Suppose that the risk-free interest rate is 10% per annum with continuous compounding and that the dividend yield on a stock index is 4% per annum. The index is standing at 400, and the futures price for a contract deliverable in four months is 405. What arbitrage opportunities does this create?

The theoretical futures price is $400e^{(0.10-0.04)\times 4/12} = 408.08$

The actual futures price is only 405. This shows that the index futures price is too low relative to the index. The correct arbitrage strategy is

Actions taken now:
a) Buy futures contracts at 405
b) Short the shares underlying the index
c) Deposit short sale proceeds

Actions taken after four months
a) Take money out of the bank
b) Take the delivery and pay 405
c) Return the shares underlying the index plus dividend
d) Count for profit

Problem 5.14
The two-month interest rates in Switzerland and the United States are 2% and 5% per annum, respectively, with continuous compounding. The spot price of the Swiss franc is $0.8000. The futures price for a contract deliverable in two months is $0.8100. What arbitrage opportunities does this create?

The theoretical futures price is $0.8000e^{(0.05-0.02)\times 2/12} = 0.8040$
The actual futures price is too high. This suggests that an arbitrageur should buy Swiss francs and short Swiss francs futures.
This is an exercise for students.

Quiz 5.3 and 5.4

The spot price of an asset is *negatively* correlated with the market. Which of the following would you expect to be true?

a. The forward price equals the expected future spot price
b. The forward price is greater than the expected future spot price
c. The forward price is less than the expected future spot price
d. The forward price is sometimes greater and sometimes less than the expected future spot price

## Chapter 6
Quiz 6.1, 6.2, 6.3, and 6.4

The price of a 90-day T-bill is quoted at a discount of 2.00 (T-bills are quoted based on 360 days). What is the actual price an investor needs to pay for the T-bill, assuming the denomination of the T-bill is $10,000?

   a.  $10,000          b.  $ 9,975         c.  $ 9,950         d.  $ 9,925

In the above problem, what is T-bill's annualized rate of return (using 365 days)?

   a.  2.122%          b.  2.100%         c.  2.071%         d.  2.038%

Problem 6.10
Suppose that the Treasury bond futures price is 101-12. Which of the following four bonds is cheapest to deliver?

| Bond | Price  | Conversion Factor |
|------|--------|-------------------|
| 1    | 125-05 | 1.2131            |
| 2    | 142-15 | 1.3792            |
| 3    | 115-31 | 1.1149            |
| 4    | 144-02 | 1.4026            |

The cheapest-to-deliver bond is the one for which the cost to deliver is the least:
    Quoted Price $-$ Futures Price $\times$ Conversion Factor

$$\text{Bond 1}: 125.15625 - 101.375 \times 1.2131 = 2.178$$
$$\text{Bond 2}: 142.46875 - 101.375 \times 1.3792 = 2.652$$
$$\text{Bond 3}: 115.96875 - 101.375 \times 1.1149 = 2.946$$
$$\text{Bond 4}: 144.06250 - 101.375 \times 1.4026 = 1.874$$

Bond 4 is therefore the cheapest to deliver.

Problem 6.14
A five-year bond with a yield of 11% (continuously compounded) pays an 8% annual coupon at the end of each year.

a) What is the bond's price?
b) What is the bond's duration?
c) Use the duration to calculate the effect on the bond's price of a 0.2% decrease in its yield.
d) Recalculate the bond's price on the basis of a 10.8% per annum yield and verify that the result is in agreement with your answer to (c).

a) The bond's price is

$$8e^{-0.11} + 8e^{-0.11\times2} + 8e^{-0.11\times3} + 8e^{-0.11\times4} + 108e^{-0.11\times5} = 86.80$$

b) The bond's duration is

$$\frac{1}{86.80}\left[8e^{-0.11} + 2\times8e^{-0.11\times2} + 3\times8e^{-0.11\times3} + 4\times8e^{-0.11\times4} + 5\times108e^{-0.11\times5}\right] = 4.256\,\text{years}$$

c) Since, with the notation in the chapter
   $\Delta B = -BD\Delta y$, the effect on the bond's price of a 0.2% decrease in its yield is
   $86.80\times4.256\times0.002 = 0.74$
   The bond's price should increase from 86.80 to 87.54.

d) With a 10.8% yield the bond's price is
   $$8e^{-0.108} + 8e^{-0.108\times2} + 8e^{-0.108\times3} + 8e^{-0.108\times4} + 108e^{-0.108\times5} = 87.54$$
   This is consistent with the answer in (c).

Which of the following day counts is applicable to corporate-bonds in the US?

a. Actual/360
b. Actual/Actual
c. 30/360
d. Actual/365


# Chapter 7
Quiz 7.1 and 7.3

Problem 7.9
Companies X and Y have been offered the following rates per annum on a $5 million 10-year investment:

|  | Fixed Rate | Floating Rate |
|---|---|---|
| Company X | 8.0% | LIBOR |
| Company Y | 8.8% | LIBOR |

Company X requires a fixed-rate investment; company Y requires a floating-rate investment. Design a swap that will net a bank, acting as intermediary, 0.2% per annum and will appear equally attractive to X and Y.

The spread between the interest rates offered to X and Y is 0.8% per annum on fixed rate investments and 0.0% per annum on floating rate investments. This means that the total apparent benefit to all parties from the swap is 0.8% per annum. Of this 0.2% per annum will go to the bank. This leaves 0.3% per annum for each of X and Y. In other words, company X should be able to get a fixed-rate return of 8.3% per annum while company Y should be able to get a floating-rate return LIBOR + 0.3% per annum. The required swap is shown below. The bank earns 0.2%, company X earns 8.3%, and company Y earns LIBOR + 0.3%.
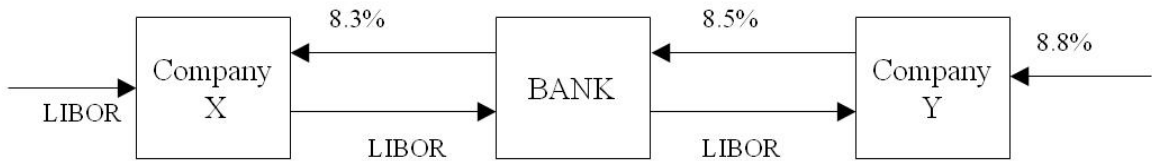
Which of the following is a use of a currency swap?

a. To exchange an investment in one currency for an investment in another currency
b. To exchange borrowing in one currency for borrowings in another currency
c. To take advantage situations where the tax rates in two countries are different
d. All of the above

## Chapter 8
Quiz 8.1, 8.2, 8.3, and 8.4

Problem 8.16
Suppose that the principal assigned to the senior, mezzanine, and equity tranches is 70%, 20%, and 10% for both the ABS and the ABS CDO in Figure 8.3. What difference does this make to Table 8.1?

| Losses to subprime portfolio | Losses to Mezz tranche of ABS | Losses to equity tranche of ABS CDO | Losses to Mezz tranche of ABS CDO | Losses to senior tranche of ABS CDO |
|---|---|---|---|---|
| 10% | 0% | 0% | 0% | 0% |
| 13% | 15% | 100% | 25% | 0% |
| 17% | 35% | 100% | 100% | 7.1% |
| 20% | 50% | 100% | 100% | 28.6% |

Suppose that ABSs are created from portfolios of subprime mortgages with the following allocation of the principal to tranches: senior 80%, mezzanine 10%, and equity 10%. (The portfolios of subprime mortgages have the same default rates.) An ABS CDO is then created from the mezzanine tranches with the same allocation of Principal. Losses on the mortgage portfolio prove to be 16%. What, as a percent of tranche principal, are losses on the mezzanine tranche of the ABS?

A) 50%
B) 60%
C) 80%
D) 100%
Note: Assume a principal of $100, then senior is $80, mezzanine is $10, and equity is $10. If the loss is 16% then the loss in principal is $16. That will wipe out the equity principal of $10 and wipe out $6 from the mezzanine tranche. The percentage is 60% (or $6/$10).