Midterm
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Instructions: Show all your work for full credit, and indicate your answers clearly.
There are six questions, each worth ten points.

1. The risk free rate with quarterly compounding is 6% per annum. The spot price of gold is $400 per ounce. The storage cost of gold is $5 per ounce per 6 months, payable in advance. A futures contract size of gold is 16 ounces. Compute the futures price of gold, to be delivered in 6 months.

2. Today is October 27. You know you will need 1000 gallons of heating oil for your home on November 27. A futures contract for oil exists (contract size is one gallon), but only for delivery on December 15. The standard deviation in the monthly change in spot price of oil is $0.25 per gallon. The standard deviation in the monthly change in futures price of oil is $0.20 per gallon. The correlation between these monthly changes is 0.8. Describe what you should do on October 27, November 27 and December 15, to hedge against the risk associated to fluctuating spot prices.

3. This problem continues on the next page

   (a) The current spot price for IBM is $70. In 6 months, the stock will be $80 with a 45% chance or $65 with a 55% chance. Compute the standard deviation of the 6 month price change of IBM.

(b) The futures price of one share of IBM with delivery date in 6 months is \$75. If you take a short position in a futures contract, what is your expected cash-flow in 6 months?

4. This problem continues on the next page.

   (a) The SPG bond is a zero coupon bond with principal $100 expiring in one year. It sells for $97. The NYP bond is a 4%-coupon bond, with coupons paid annually, with principal $100 expiring in two year. It sells for $100. Find the one year spot rate, the two year spot rate and the forward rate from years one to two.

(b) The NHV portfolio is made of two SPG bonds and 1 NYP bond. Compute the yield, duration, and convexity of the NHV porfolio. Use both the duration and the convexity to estimate the **new price** of the porfolio when the yield increases by 250 basis points.

5. Companies A and B have been offered the following annual rates for borrowing money, with interest due semi-annually.

Company	US Dollars	Japanese Yen
A	5.4	7.0
B	4.4	6.8

Company A wants to borrow 10 million US dollars; company B requires a loan for 1200 million yen. The current exchange rate is 120 yen to the dollar. Design a swap that will net a bank, acting as an intermediary, 30 basis points, and that will appear equally attractive to A and B. Design it so that company A bears all the risk of foreign currency exchange rate. Moreover, since the bank is based in Japan, it wants its profit in yen only. How many yen does A pay or receive every 6 months?

6. Lex Luther owns one pound of Krypton. He will need it in a few years for his final conflict with Superman, but for now, it is used as a lawn ornament (there are no storage costs or dividends associated to krypton). Today, Lex can buy up to one pound Krypton at $1000/pound and sell up to one pound at $990/pound. The risk free rate is 6% per annum with semi-annual compounding. Suppose the futures price of one pound of Krypton with delivery in one year is $1500. Describe the best arbitrage opportunity for Lex. Include his profit in terms of today's dollars.