Assume a continuously compounding dollar interest rate of 5% for all maturities, whenever applicable.

1. (30) If you go short a 2-year forward contract on a security with a delivery price \((K)\) of $100,

   (a) (10) What is your payoff at expiry if the security price at expiry \((S_T)\) is $90, $100, $110.52, and $120, respectively? (Reminder: Four answers to the four different scenarios.)

   (b) (5) Plot your payoff at expiry as a function of the security price at expiry.

   (c) (5) If the forward is on a stock with a current spot price \((S_t)\) of $50, the present value of the dividend payments over the next two years is $5. There are no other costs or benefits in carrying the stock except interest cost. What should be the current forward price \((F)\) on the stock with a 2-year maturity?

   (d) (5) Based on your calculated forward price, what is the current value of your short position on the 2-year forward with a delivery price of $100?

   (e) (5) If the market quote for the 2-year forward is $50 (with zero bid-ask spread), is there an arbitrage opportunity? How can you set up trades to exploit the opportunity?

2. (10) Consider a 5-year forward contract on the exchange rate, dollar price of pound. The current spot price for pound is $2.00. The 5-year dollar interest rate is 5% as assumed above, and the 5-year pound interest rate is 6% (continuous compounding).

   (a) (5) Compute the 5-year forward price on pound.

   (b) (5) If the market quote for the forward price is $2.00 (zero bid-ask spread), is there an arbitrage opportunity? How can you set up trades to exploit the opportunity?

3. (10) Suppose you are long a European put option on a security with a strike of $100, what will be your payoff at the option expiry if the security price at expiry is $90, $95, $100, and $110, respectively?

4. (25) You long a European put at $20, and short a European put at $10 on a stock, both at 2-year maturity.

   (a) (10) What is the portfolio payoff if the stock price at expiry is $5, $10, $15, $20, $25, respectively?

   (b) (5) Plot the portfolio payoff at expiry as a function of the security price level at expiry.

   (c) (10) We expect the stock price to fluctuate over time, but we are sure that the stock price will stay above $30 as long as the company is not going bankruptcy. However, when the company does go to bankruptcy, the stock price will drop below $2 and will never be able to recover.

      i. Under these assumptions, what kind of payoff do you expect from your portfolio in all possible scenarios? (Hint: Stock price goes to 20 is not possible)

      ii. Can you make up another portfolio of put spreads (long one, short the other) using different strikes to generate the same payoff?

5. (15) An European put option with strike of $100 and maturity of 1 year has a value of $15. The forward price of the security at the same maturity is at $90.

   (a) (7.5) Based on the forward price, is this put option in the money, out of the money or at the money?

   (b) (7.5) What are the intrinsic value and time value of the option?

6. (10) Consider a security with a forward price of $120 at 2 year maturity. The European call option price at the strike of $100 and 2-year maturity is quoted at $17. Is there an arbitrage? If so, how do you do the arbitrage trading to profit from it?