Assume a continuously compounding dollar interest rate of 4% for all maturities, whenever applicable.

1. (25) If you are long 200 1-year forward contracts on a security with a delivery price ($K$) of $2,

   (a) (5) What is the payoff to your position at expiry if the security price at expiry ($S_T$) is $1, $1.5, $2, and $3, respectively? (Reminder: Four answers to the four different scenarios.)

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

   (c) (5) If the forward is on a foreign currency (pound) with a current spot price ($S_t$) of $1.6. The pound continuously compounded interest rate is assumed to be 6% at all maturities. What should be the current 1-year forward dollar price ($F$) on pound?

   (d) (5) Based on your calculated forward price, what is the current value of your position on the 1-year forward with a delivery price of $2?

   (e) (5) If the market quote for the 1-year forward is $2 (with zero bid-ask spread), is there an arbitrage opportunity? How can you set up trades to exploit the opportunity?

2. (50) Suppose you have bought a contract that gives you the right, but no obligation, to sell 100 shares of google stock at $300 per share exactly one year later (not before or after).

   (a) (5) What do we call such a contract? (Forward or option? European or American? Call or put?)

   (b) (5) What’s the strike of the contract? What’s the time to maturity of the contract?

   (c) (10) Google currently trades at $370 and does not pay dividend. What’s the fair value for a one-year forward on google? Based on its forward price, determine whether the above contract is in-the-money, out-of-the-money, or at-the-money?

   (d) (5) Suppose the contract is priced at $52 for each google share ($5,200 for the whole contract, which includes 100 shares). What’s the intrinsic value of the contract? What’s the time value of the contract?

   (e) (15) Suppose you are also offered another contract that gives you the right, but no obligation, to buy 100 shares of google at $300 per share exactly one year later.

      i. (5) How does the name of this contract differ from the previous one? (Just like what I asked in 2(a)).

      ii. (2.5) Is it in the money or out of the money?

      iii. (7.5) Based on the above information on the previous contract, what should be the fair price of this new contract? What should be its intrinsic value? What should be its time value?

   (f) (5) Google’s stock price is going up from $370 to $400. With everything else fixed, how does this price movement affect the values of the above two contracts, respectively? (Just say increase or decrease).

   (g) (5) Given the market turmoil, Google stock’s volatility has doubled. With everything else fixed, how does the volatility spike affect the values of the two contracts, respectively?
3. (15) Market is down dramatically, and volatility is going through the roof. You have a strong view on where the market is heading and you are about to put your money to where your mouth is in the derivatives market. How are you going to bet with index futures and/or options for each of the following viewpoints?

(a) (5) The worst has not come yet. The market will go down a lot more, and market volatility will go even higher as the panic spreads.

(b) (5) The market will stay low for a while, but panic will dissipate and volatility will come down.

(c) (5) The market will bounce back starting tomorrow and never look back again, but you do not have a view on volatility.

4. (10) Use a portfolio of European call options, put options, forwards, and/or bonds to replicate the payoff in the following figure. You can, but you do not need to use all of the above.