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

1. **Simple answer questions**

3 points for each question. Final answer only. No intermediate steps or explanations needed. No partial credits.

1. Google (GOOG) is currently priced at $560. The stock does not pay dividend.
   
   (a) If you are long 2-year call options on 200 shares of GOOG struck at $600, what will be the payoff at the expiry if the stock price at expiry is (i) $560 (________), (ii) $600 (________), (iii) $610 (________)  
   
   (b) If you are short 1-year forwards on 50 shares of GOOG with delivery price of $560, what will be the payoff at the expiry if the stock price then is (i) $540 (________), (ii) $560 (________), (iii) $580 (________)  
   
   (c) If you are short 1-month put options on 1 share of GOOG struck at $540, what will be the payoff at the expiry if the stock price at the expiry is (i) $520 (________), (ii) $560 (________), (iii) $580 (________)  
   
   (d) If you are long a 3-year straddle on 100 shares of GOOG struck at $560, what will be the payoff at the expiry if the stock price at the expiry is (i) $520 (________), (ii) $560 (________), (iii) $580 (________)  

2. The current pound-dollar exchange rate is $1.50 per pound. Assume the continuously compounding pound interest rate is 1% at all maturities.

   (a) What should be the fair forward dollar price of pound at (i) one-year maturity (________), (ii) 5-year maturity (________)?  
   
   (b) If you are short a 2-year forward contract on 100 pounds with a delivery price of $2.00 per pound, how much is your position worth now (________)?  

3. The IBM stock price is $150. The company pays $5 per share as dividend at the end of each year (assume now is the beginning of a year).

   (a) What should be the fair forward price for IBM stock at (i) one-year maturity (________), (ii) 2-year maturity (________)?  

   (b) If you are long a 1-year forward contract on 100 shares of IBM with delivery price of $150 per share, how much is your position worth now (________)?  

4. You are long 100 contracts of straddle on S&P 500 index. The equity market suddenly becomes much more volatile than before. Do you expect your portfolio value to increase or decrease? (________)  

5. You are short 100 contracts of puts on S&P 500 index. The equity market is crashing. Do you expect your portfolio value to increase or decrease? (________)
2. Essay questions

Partial credits possible.

6. (15) Write the terminal payoff function, and plot it, for the following portfolio that consists of (i) long a $20-par zero-coupon bond, (ii) short $80-strike call on 2 shares of AAPL, (iii) long $90-strike call on 4 shares of AAPL, (iv) short $100-strike call on 4 shares of AAPL, (v) long $110-strike call on 4 shares of AAPL, and (vi) short $120-strike call on 2 shares of AAPL, all at the same one-year expiry.

(a) (5) Write the payoff in terms of the AAPL spot price at expiry (\( S_T \)).

(b) (5) Plot the payoff as a function of \( S_T \).

(c) (5) What will be the payoff if the AAPL spot price at expiry is $20, $90, $100, $110, $400, respectively?

7. (25) Currently (beginning of a year), AAPL stock is traded at $130 per share. One-year $100-strike put is traded at $3.00, and one-year $100-strike call is traded at $36.09. Dividend is paid at the end of each year.

(a) (5) Among the two $100-strike options, which one (call or put) is out of money?

(b) (5) From the option prices, infer the value of the forward contract with a delivery price of $100.

(c) (5) From the option prices, infer the one-year forward price on AAPL.

(d) (5) Infer the dividend per share paid at the end of the year? (round of cents)

(e) (5) If there is actually no dividend payment, (how) can you construct an arbitrage trading between the two options and the stock?