Sample exercise questions for the midterm
FIN9797: Options Markets, Liuren Wu

1. If you long a forward contract on a security with a delivery price of $100,

   (a) What is your payoff at expiry if the security price at expiry \( S_T \) is $80? What is your payoff at expiry if the security price at expiry is $120?

   (b) Plot your payoff at expiry as a function of the security price at expiry. Use the security price as the x-axis and the payoff as the y-axis.

   (c) How do your answers to (a) and (b) change if you short this forward contract instead?

2. If you long a zero-coupon bond with $50 par value,

   (a) What is the payoff at the bond expiry if the stock index is at $120? What is your payoff at expiry if the index is at $45?

   (b) Plot your payoff at expiry as a function of the index level at expiry. Use the index level as the x-axis and the payoff as the y-axis.

   (c) How do your answers to (a) and (b) change if you short the zero-coupon bond instead?

3. If you bought a stock yesterday at a price of $45, and the stock does not pay dividend in the near future,

   (a) What is the payoff if you decide to sell the stock one year later and the stock price at that time is $56? What is your payoff at expiry if you can sell the stock at $65 instead?

   (b) Say you want to sell the stock one year later, plot your payoff at the time of sale as a function of the stock price at that time.

   (c) How do your answers to (a) and (b) change if you short sold the stock instead?

4. If you long a European call option on a security with a strike of $80 and an expiry date at one year later,

   (a) What is the option payoff at expiry if the security price one year later is $100? What is the payoff at expiry if the security price one year later is $90?

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

   (c) How do your answers to (a) and (b) change if you have a short position in the call option instead?

   (d) If currently the security price is $100 and its forward price is $101, is this call option in-the-money, out-of-the-money, or at-the-money? What’s the option’s intrinsic value? (Assume that the interest rate is 5%).

   (e) How do your answers to (d) change if the current security price is $60 and its forward price is $60.5? (Assume that the interest rate is 5%).

5. If you long a European put option on a security with a strike of $80 and an expiry date at one year later,
(a) What is the option payoff at expiry if the security price one year later is $100? What is the payoff at expiry if the security price one year later is $90?

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

(c) How do your answers to (a) and (b) change if you have a short position in the put option instead?

(d) If currently the security price is $100 and its forward price is $101, is this call option in-the-money, out-of-the-money, or at-the-money? What’s the option’s intrinsic value? (Assume that the interest rate is 5%).

(e) How do your answers to (d) change if the current security price is $60 and its forward price is $60.5? (Assume that the interest rate is 5%).

6. If you have a portfolio of derivatives on the same underlying security. The portfolio is composed of

(a) Long 1 forward contract with a delivery price of $100, and maturity of one year.
(b) Short 1 European call option contract with a strike price of $100 and maturity of one year.
(c) Long 1 European put option contract with a strike of $100, and a maturity of one year.

What is your payoff one year later if the security price is $70 one year later? What is the payoff if the security price is $110? Plot the payoff as a function of the security price?

7. If you have a portfolio of derivatives on the same underlying security. The portfolio is composed of

(a) Long 2 forward contracts, both with a delivery price of $100, and maturity of one year.
(b) Long 1 European call option contract with a strike price of $80, and maturity of one year.
(c) Long 1 European put option contract with a strike of $100, and a maturity of one year.
(d) Short 1 European put option contract with a strike of $80, and a maturity of one year.

What is your payoff one year later if the security price is $70 one year later? What is the payoff if the security price is $110? Plot the payoff as a function of the security price?

8. Plot and understand the payoff of the following portfolios (they all have the same expiry date, options are European):

(a) Long 1 call at $80, long 1 put at $80.
(b) Long 1 call at $80, short 1 put at $80.
(c) Long 1 put at $80, short 1 call at $120.
(d) Long 1 put at $80, long 1 call at $120.
(e) Long a forward at $100, short 1 call at $120, and long 1 put at $80.
(f) Long 1 call at $80, long 1 put at $120, short 1 call at $100, short 1 put at $100.

9. Today, the dollar price of pound is $2.00. At two year maturity, the dollar interest rate is 5%, and the pound interest rate is 6% (both are continuously compounding).

(a) What’s the forward dollar price of pound at 2 year maturity?
(b) If the forward price is $2.00, is there an arbitrage opportunity? If there is, how do you do the arbitrage trading to profit from it. Assume zero transaction costs (bid-ask spread etc).
(c) If the forward price is $1.50, is there an arbitrage opportunity? If there is, how do you do the arbitrage trading to profit from it. Assume zero transaction costs (bid-ask spread etc).

10. Today the stock price of Google is $640 per share. Assume that the dollar interest rate is fixed at 4% across all maturities. Assume that Google is not going to pay any dividends during the next 5 years.

   (a) What’s its forward price with half year maturity? What’s its forward price with 4-year maturity?
   (b) If the forward price at half-year maturity is $670, is there an arbitrage opportunity? If there is, how do you do the arbitrage trading to profit from it?

11. Given a fixed 5% interest rate, what’s the current value of a $100 par zero-coupon bond at 2-year maturity? What’s the current value of a $50 par zero-coupon bond at 3-month maturity?

12. Consider a European call option with strike of $100 and maturity of one year. The current 1-year forward price is $120. The call option is quoted at $18. The dollar interest rate is fixed at 5%.

   (a) Is there an arbitrage opportunity? If there is, how do you do the arbitrage trading to profit from it?
   (b) If the call is quoted at $121, is there an arbitrage opportunity? If there is, how do you do the arbitrage trading to profit from it?

13. We intend to price options on a binomial tree. We assume that the current spot price of the security is $100. 6-month later, the security price can either go up to $120, or go down to $80. The dollar interest rate is fixed at 5%.

   (a) Based on the above assumption, price a 6-month call option with strike $110.
   (b) Based on the above assumption, price a 6-month put option with strike $100.
   (c) If the market quote for the call is $4, is there an arbitrage based on your model assumption?
   (d) If the market quote for the put is $9, is there an arbitrage based on your model assumption?